

I. ROSET

The Psychology of Phantasy



Progress Publishers

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The Psychology of Phantasy

*An Experimental
and Theoretical Investigation
into the Intrinsic Laws
of Productive Mentality*



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ПСИХОЛОГИЯ ФАНТАЗИИ

**Экспериментально-теоретическое исследование
внутренних закономерностей
продуктивной умственной деятельности**

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FOREWORD

According to a seemingly paradoxical opinion, the deeper we penetrate into the subject of our investigation the more mysterious and enigmatic it appears to us. This fully complies with the scientific assessment of the extent of our knowledge in the sphere of psychology of creativity. As early as 1898 the French psychologist Frédéric Paulhan, author of a work on imagination and invention, stated categorically that "we have learned by now the general principal conditions of an invention" (226, 227).*

Meanwhile, sixty years later, one of the collected articles on the problems of creativity read: "We are now, by way of analogy, more or less at the stage of Tycho Brahe's investigation of planetary motion. We need more Brahes to collect information about creativity, then the Keplers to organise this information into probable, useful patterns, paving the way for future Newtons to offer hypotheses that will really encompass our observations and, what is more important, lead to fertile predictions. Beyond that we may expect future Einsteins to build upon, alter, and expand upon the foundations established by the Newtons" (137, XVII).

It took the intensive efforts of several generations of scholars to fathom the gap between the existing theoretical deductions advanced as explanations of creativity and the truths that are comparable with the laws established by Kepler and Newton in the sphere of physical phenomena.

In spite of the fact that numerous philosophical problems

* Here and throughout the book, the first figure enclosed in parenthesis indicates the number of a source as listed in the bibliography, and the second figure (following the comma), the page.

of phantasy were raised even by Ancient Greek and Roman thinkers, not a single universally accepted conception of the subject-matter of our investigation has been adopted up to now. We do not want to confine ourselves merely to definitions of the term "phantasy", and, least of all, to different theoretical interpretations of the same phenomenon. A divergence of theoretical approaches to various facts characterises all the branches of psychology, yet the advocates of polar theoretical views are often unanimous in selecting a phenomenon to which rival theories can be applied. Remarkably, no matter what angles various scholars may take to explain amnesia and other mnemonic phenomena, their argument is invariably focused on the same subject. On the other hand, in a great number of psychological systems the notion of phantasy has discrepancies both in content and in volume. Moreover, there are authors who disregard this notion as superfluous and as fully overlapped by other psychological notions. Various views of the notion of "phantasy" expressed by Soviet psychologists have been extensively discussed by O. Nikiforova (42).

All this explains the necessity for delimiting the scope of phenomena lying at the foundation of the problems of phantasy in order to ensure its successful investigation. In anticipating the conclusions arrived at in Chapter I which is especially meant to specify the subject of our investigation, we would like to emphasize that we regard phantasy as any *productive mental activity* regardless of the sphere of its application, the goals pursued by the subject involved in this activity, and, finally, the material used for the investigation. Therefore, in contrast to the view once expressed by Wilhelm Wundt and still shared by certain psychologists which identified phantasy with thinking in images (279, 548), we assert that it (phantasy) may find its expression both through imagery and verbal-and-logical material, and may be applied to art, science, technology and human relations in equal measure.

This also causes us to reconsider the significance of various aspects of the problems of phantasy. Thus, at one time, the narrowed interpretations of phantasy suggested by Wundt evoked an enormous surge of interest in the introspective phenomenology of this process and resulted in a neglect of its inner mechanisms. At the same time, the prime purpose of this investigation is to reveal through experiment certain *intrinsic laws* of phantasy. We also made an attempt to use our conceptions of phantasy for explaining facts obtained by other scholars and employed to support other theoretical views.

In addressing this book to the English reader I hope that it will help him realize that in spite of certain essential methodological divergencies the author has widely used the concrete achievements of his colleagues abroad trying, to say it with William Shakespeare, to find "some soul of goodness" * wherever possible.

* Shakespeare, *Henry V* (IV, 1). — *Translator.*

INTRODUCTION

As philosophy and psychology developed, considerable changes have been observed in the attitude toward phantasy as a scientific problem. Works by the ancient philosophers contained explicit characteristics of phantasy as well as attempts to explain it. In particular, the Roman philosopher Lucretius Carus, a follower of Epicurus, wrote in his famous poem *De Rerum Natura*:

*For certainly no image of
a Centaur comes from one living, since there never
was a living thing of this nature; but when the
images of man and horse meet by accident, they
easily adhere at once, as I said before, on account
of their fine nature and thin texture.
All other things
of this class are made in the same way.*

What we have here is a complete, though extremely naive, theory of phantasy. In objecting to idealist Plato who maintained that only deities were endowed with the ability to create, Lucretius Carus asserted that new images sprang from accidents and combinations:

*Images of all kinds are being
carried about everywhere, some that arise spontaneously
in the air itself, some that are thrown off from
all sorts of things,
others that are made of a combination of these shapes.*

Rationalist philosophers Descartes and Spinoza associated the creative principle with comprehension and logical thinking rather than with images. The great scientists, Pascal and Newton, went even farther by renouncing phantasy and viewing it as antipodal to reasoning.

While Leibniz had utilized idealist grounds to overcome the Cartesian juxtaposition of the thought and the image, Hume and the entire empiric psychology that followed in his footsteps chose a different path: they confined the whole content of man's psyche to a complex system of images, and presented creativity as a corollary based on association by contiguity, similarity and contrast. Nonetheless, as a psychological function imagination attracted great attention from the whole of associative psychology and numerous works devoted to creativity, invention, etc. emerged on its foundation. The mid-19th century saw numerous monographs and articles on concrete kinds of creativity in the sphere of mathematics, physics, literature, painting, music and mechanics, each viewing phantasy as the indispensable component or precondition for creativity. James Joseph Tissot maintained that phantasy contributed immensely to the historical development of mankind through enlarging its capacity for perceiving innovation, education and progressive ideas (264, 10-18). According to Dugas imagination highly contributed to the evolution of scientific thought: "It is imagination that creates science, poses questions, anticipates solutions, organizes researches and furnishes proofs" (143, 275). In discussing the significance of imagination for fiction literature, Edwin Slosson and June Downey had to stress that "there must be some measure of mental flexibility, some possibility of invention, of striking new situations" (249, 17).

However, in major psychological systems which succeeded associationism, phantasy was almost completely ignored. The Würzburg school, the behaviorists and the Gestaltpsychologists were absolutely oblivious of phantasy, and in the few cases when this term was used (for instance, in some early works by J. B. Watson) it appeared merely as a target for criticism. The only exception from this practice was psychoanalysis which never underestimated the significance of phantasy.

Even though the term of phantasy was subject to virtual ostracism, questions which constituted its problematics continued to evoke the interest and concern of various scholars. Thus, in the 1920s-30s, Gestaltpsychologists Max Wertheimer and Karl Dunker published important works on creativity in which they avoided using the term "phantasy" at all, substituting it with the expression "creative thinking". At the same time a number of problems which had a direct bearing on phantasy (including arts, technological, literary and stage creativity) were studied both by specialists in the conformable fields and by psychologists; in this connection it is worth mentioning works by Soviet

scholars E. I. Ignatyev, P. M. Yakobson, A. G. Kovalyov and others. Yet, phantasy did not appear in these few works as a specific psychological problem, rather it was treated as a certain component of certain activities in which the major role was attributed to specific skills and abilities. No special investigation was made either into the psychological nature of phantasy or into its intrinsic laws. Moreover, there were attempts to discard the term "phantasy" as unscientific.

The mid-1950s saw a drastic change in psychologists' attitude toward phantasy. Calvin Taylor, who is one of the leading investigators of the problems of creativity, wrote: "In six or seven decades before 1950, only a trickle of research articles on creativity appeared in the scientific literature. Since 1955, however, increasing interest and activity have opened many avenues of research" (258, 2). Since that moment an extraordinary increase in enthusiasm has been displayed towards the problems of creativity. Some American universities (for instance, those in the Utah State) initiated regular scientific symposia on creativity, made extensive and intensive experimental studies of its various aspects, and published an enormous mass of literature on that subject. As Joy Paul Guilford justly noted on the radical change of attitude toward creativity: "No phenomenon or subject ... was so seriously neglected for so long or came to life so suddenly as that of creativity" (170, 419).*

The revived interest in the psychology of creativity rests, first and foremost, on deep-rooted social reasons. American scientists maintain that the problem of revelation and edification of creative personalities is of national significance for the USA, since, according to Calvin Taylor, "creative acts affect enormously not only scientific progress, but society in general, those nations who learn best how to identify, develop, and encourage the creative potential in their people may find themselves in very advantageous positions" (258, 2).

Special significance is attached to the creative approach under the conditions of drastic changes in social life as long as it helps us overcome various difficulties, plan new unexpected targets, and gives increased freedom of choice and thus greater freedom of action (181, 47-59). The creative approach facilitates education, making it more economical and effective (266, 72).

* The emergence of the new term "creativity" in the English scientific literature resulted from an increase of interest in the subject. The use of this term varies in meaning, from creative process and creative approach to creative production and person's creative potential.

In recent publications, creativity is identified with a prerequisite for mental health and inner accomplishment (266, 52; 100, 376); it is noted that creativity is an efficient instrument of controlling both children's impulses and the adult personality (183, 10, 77). In the opinion of certain authors, lack of phantasy in the life of man is likely to lead to all kinds of nervous and psychic disorders, alcoholism, drug-addiction, strange obsessions (144, 463), boredom, desolation and even suicides (183, 18), while the "artistic segment of personality" provides immunity against the various deleterious affects and insanity, and moreover, contributes to recuperation.* One of the psychotherapeutic methods suggested by Joseph Wolpe is based on evoking special forms of images (277). Alex Osborn asserts that "the history of civilization is essentially the record of man's creative ability. Imagination is the cornerstone of human endeavour ... and it has caused him [man], as a human being, to conquer the world" (225, VII-VIII). Finally, one of the books went so far as to place phantasy (imagination) on a par with real capital, like industrial and financial capital (124). The unjustified exaggeration of the role of phantasy is quite conspicuous in similar assertions and it results from idealistic comprehension of social phenomena**.

However, a recognition of the role of intellectual factors, including phantasy, in the historical progress does not run counter to its correct, materialist comprehension. According to Karl Marx, imagination is "a great gift that has contributed so much to the development of the mankind" (2, 45). In one of his speeches, Lenin had this to say about the imagination: "It is wrong to think that only poets need imagination. That is a silly prejudice! It is needed even in mathematics; it would

* Most relevant here are the following lines by Heinrich Heine: *Erschaffend konnte ich genesen, Erschaffend wurde ich gesund* (I was creating to recover, creativity made me whole again).

** It is important to emphasise that the sudden surge of interest toward the problem of creativity failed to engender simultaneously any theories or concepts of creativity entirely new in principle. In the chapters that follow we will show that investigators normally based their explanations of facts in the sphere of phantasy on established traditional theoretical views, seeking their maximum utilisation for practical purposes. Recent foreign publications on creativity are mostly confined to the problems posed by modern production, commerce, military agencies, etc. For instance, how can engineering and strategical thought be encouraged, or goods sales increased? The current weakening of the creative boom of the 1950s-70s has most likely resulted from a saturation of the book market with works containing various stock-in-trade recipes for stimulating creativity.

have been impossible to discover the differential and integral calculus without imagination. Imagination is a very valuable asset" (4, 318).

Thus, the turning of attention toward creativity and phantasy occurred only after the social significance of these problems had been fully realized. The other equally important reason for the increase of interest in creativity lies in the very logic of the internal development of psychology as a science. In penetrating deeper and deeper into the essence of the psychic, researchers could not help confronting a special class of facts which could not be reduced to perceptive, mnemonic or even algorithmic intellectual laws. Conceding that mechanistic methodology (especially, behaviorism) managed to fit facts of creativity under these laws, the same substitution of the thesis at present may no longer be tolerated by either psychologists (122, 9), or, the more so, cyberneticians, who, in designing devices to simulate creativity, are especially in need of adequate information on the actual laws of phantasy.

The prolonged disregard of phantasy has had its effect on the terminology of recent works on creativity: the words "fantasy" and "phantasy" are highly infrequent in these works, although certain researchers, for instance, R. R. Holt and J. L. Singer, are very plain about the revival of interest in phantasy. Undoubtedly, apart from terminology, the very problems of imagination have undergone modification, which explains the need to establish continuity between the traditional problems of the phantasy and the contemporary problems of creativity. And this in the first place requires a consideration of the concepts "phantasy" and "creativity".

Chapter I

THE SUBJECT OF INVESTIGATION

The problem of choosing an approach to the notion of phantasy was raised by the authors of the early works on that subject. They posed such questions as: what has to be used as its basis and what aspects of psychological reality have to be reflected in its definition? Moreover, there are psychologists, such as Theodor Elsenhans and his follower Kate Gordon, who doubted that the essence of phantasy was integral. Can we, they argued, be dealing with a whole series of diverse psychological phenomena that have accidentally been unified by the same term? (149, 31; 165, 194).

Traditional definitions of course present the subject through its genus and specific difference. In compliance with a theoretical conception, in the definition of phantasy the generic concept is attributed, alternately, to a specific psychic power (Dugas, "pouvoir"; Gordon, "power"), to an ability (Bernis, "faculté"; Elsenhans, "Fähigkeit"), to a function of consciousness (Lindworsky), to a state of consciousness (Nechayev), or to a process (the majority of authors). Despite the diversity of the generic concepts associated with phantasy, the specific distinctive feature coincides almost completely in all the definitions to show that this power, ability, or function produces something entirely *new*, i.e., new images, unconventional ideas, compositions, new combinations of images and ideas, new dependences, etc.

These definitions describe the psychic process under investigation from the angle of the *results* achieved on its basis. Nonetheless, certain definitions of this mental activity reveal its psychological essence through the *goals* it is pursuing. A number of French scholars, beginning with James Tissot, ascribed to those goals of phantasy the ability "to render as sensible that which does not exist, that which even may not exist" (264, 4). In discussing the same goals of phantasy (imagination), Dugas and especially Bernis identified its main

property as the ability to expose an object "as present although it is really absent" (123, 94). The conception of phantasy as a psychological activity which creates the *non-existent*, and which thereby to some extent stands opposed to reality, complies with the orthodox view of phantasy as a departure from reality to a realm of dreams and castles in the air. This orthodox view has been retained in scientific literature up to the present. J. M. Fraser, for instance, writes that an escape into a day-dream satisfies us in what our ordinary life denies us. Thus one way or another everyone indulges in phantasy (153, 83).

Some psychologists, Rudolf Arnheim in particular, tend to moderate the categoric definition which confines phantasy to creating the nonexistent, pointing that it would be more advisable to discuss the creation of nonexisting forms for existing contents or look for a new approach to the existing subject.

Some authors see another goal of phantasy in introducing order into disorder, or chaos, the latter being recognized as something primordial or initial according to the tradition deriving from Plato and ancient Greek mythology. John Livingston Lowes who also shares this view endows the poet and his phantasy (imagination) with the ability to bring a multitude of random, amazingly intertwined legends created by different peoples in various epochs, a multitude of images, visions and vague sensations into a whole, complete and coherent story (206, 426).

It becomes obvious that in characterizing phantasy through the goals pursued by a fancying person we identify imagination with the creation of something new. Indeed, any "non-existent" phenomenon manifests itself as something new, which may also be attributed to the characteristic of phantasy as creation of order out of disorder or chaos.

Analogous characteristics of phantasy may also be found in negative definitions. Kate Gordon holds that as long as it is easier to give negative definitions to psychic phenomena in general (the psychic being opposed to the physical as having no continuity), images of phantasy, too, may be regarded as entities which have no influence on senses (165, 198). A similar idea was also expressed by A. Nechayev: "Imagination (or phantasy) signifies the state of consciousness, analogous to perceptions, yet having no correspondence with active stimuli" (41, 1). In a number of negative definitions, phantasy is juxtaposed to other psychic processes. Dugas wrote in this connection that "imagination awakens at the same time with senses and memory,

but instead of following them it directs these processes; instead of adapting itself to them, it deforms them" (143, 199).

The essence of the negative definitions of phantasy, as well as its descriptions by way of comparing it with other psychic processes is narrowed down to the assertion that its images must be in this way or another different from the perceptive images; in other words, they must contain something *new* in comparison with the latter.

The notion of "creativity" has long coexisted with the notion of phantasy, the former deriving from Plato's and Aristotle's works. Aristotle regarded creativity in the broad sense of the word: according to him, to create meant to produce something unprecedented. This definition does not only embrace creativity in the sphere of the psychic alone, for it also includes a concept's material realization. Such understanding of creativity is shared by some authors, especially those who have been concerned with special kinds of creativity.

However, dominant in recent investigations into creativity has been an interest in the key link of creative activity, i.e., in the laws and mechanisms that govern the emergence of a specific psychic product.

In summarizing various definitions of creativity Ralph J. Hallman writes: "Creativity is the fusion of perceptions in a new way (McKellar), the capacity to find new connections (Kubie), the emergence of novel relationships (Rogers), the occurrence of a composition which is new (Murray), the disposition to make and recognize innovations (Lasswell), an action of mind that produces new insights (Gerard), the molding of experiences into new organizations (Taylor), the presentation of new constellations of meanings (Ghiselin)" (175, 21).

The generally accepted realization of creativity in Soviet psychology is expressed by I. B. Gutchin, who writes: "Creativity is man's purposeful activity in creating new material and spiritual values of social significance... Creativity invariably contains startling and novel elements" (21, 9).

In the same way as in the definition of phantasy, the generic concept into which creativity is introduced will vary in compliance with an investigator's theoretical position, while the novelty of response to a specific situation will mainly stand forth as specific distinctive feature common to all the definitions. On the other hand, this novelty may lie in the irregularity of the problem situation and in the unexpectedness of a task's conditions. In that sense, creativity as well as phantasy may easily receive a negative definition. "To be

deemed creative, a product of a thought process must be initially improbable and hence unpredictable" (122, 317).

The above-mentioned definitions characterize creativity through its product. The argument still goes on between the psychologists who believe that creativity must be defined "in terms of a product" and the psychologists who maintain that nothing is more important in creativity than the very process of creation. D. Taylor advocates the former view (259, 108). That creativity must be conceived as a process is most explicit in the work by Rudolf Arnheim who asserted that "we can no longer identify creativity by the sort of object it produces... Creativity is ... full deployment of knowing, doing and willing" (110, 376).

There are also definitions of creativity which emphasize the qualities of a creative personality. Thus Merrill F. Roff tries to prove that the term "creativity" is as much in the air as is the other term, "talent" (236, 43). Calvin Taylor singles out three main qualities of a creative personality: "*breadth*, indicating, in general, span of consciousness, inclusiveness in envisaging matter of any kind...; *flexibility*, or easy, swift, and free movement from one configuration or group of configurations to another; and *indeterminacy...*" (258, 24). J. P. Guilford points out that "we can define 'creative potential' as a collection of abilities and other traits that contribute toward successful creative thinking..." (169, 96).

There is every reason to conclude that the definition of creativity through the qualities of a creative personality along with the definition of creativity through its product place the very process of creativity in the background since it associates the process, not with the general laws inherent in every person, but only with the individuals endowed with special qualities. The above positivist, operational definitions of creativity which ignore the essence of the process were characterized in the *Annual Review of Psychology* by John P. Van de Geer and Joseph M. F. Jaspars who wrote: "Creativity at this moment still looks somewhat intangible. Of course, one may always reduce it to something which conforms to the research tools we happen to have (an originality index for associations, the ability to think of many uses for a hammer). Such an operational definition, however, may imply a premature curtailment and may close doors before one has explored what is behind them [human qualities.—I.R.]" (158, 148).

Given that creativity may be expressed through certain qualities of a creative personality, the whole problem of creativity,

according to Spearman's witty remark, will be, essentially, reduced to separating the people capable of creativity from those incapable of it. However, the definitions of creativity through man's qualities imply references to the signs of novelty (the ability to experience and evaluate it even in well-known everyday phenomena, the readiness to challenge conformists in the name of novelty, etc.).

When comparing traditional definitions of phantasy with contemporary definitions of creativity we may, quite reasonably, discern their common essential features: the fact that in both cases we are dealing with the creation of something novel and original. Like phantasy, creativity stands opposed to simulation, imitation and copying, and this means that psychologists who are concerned with the study of phantasy and creativity examine one and the same entity irrespective of the difference in terminology. This was noticed by several authors. Michael A. Wallach, for instance, in his critical article on C. Taylor's investigations wrote: "It is hard to come away from the present book without feeling that the term [creativity] covers what in other times may have been called by such names as intelligence, giftedness, sensitivity, education, insight, discovery, thinking, intuition, problem-solving, and learning" (270, 518).

Throughout the whole of his book *Applied Imagination* Osborn is using the terms "creativity" and "imagination" synonymically. This adds special significance to the fact that some authors reveal the notion of imagination through the notion of creativity. Thus, Hargreaves regards imagination (phantasy), in general, as the "creative power of the mind", a power producing new psychological combinations (177, 2). Soviet psychologist L. V. Novsova points out that "creative imagination ... is characterized by unconstrained production of new images realized in the original and valuable products of creativity" (43, 4).

All this leads us to the assertion that the main issue running through all contemporary investigations into creativity is, essentially, nothing other than the traditional problem of imagination: *what conditions the creation of what is new?* What causes the emergence of new images, ideas, thoughts, solutions, etc.?

The concept of the novel also calls for clarification. One wide-spread approach has it that in the context of psychological investigations, the notion of the new should not have universal implication, for it has to be limited to a particular subject or a specific individual. Donald W. Taylor also shares this view (259, 111), supporting it by the following example: if a person who had never studied arithmetic conceived the

multiplication table himself, it may be psychologically regarded as a discovery. Yet, there are psychologists who believe that no matter how infinitesimal and trivial a change, it still may be considered novel (115, 262). Truly, a broad concept of innovation like this is often criticized. Abraham S. Luchins emphasizes that an overly expanded interpretation of innovation may equate creativity with any other activity or with mere being. This makes the notion "creative" superfluous (207, 130).

In many instances the notion "innovation" or "novelty" (otherwise, "originality") has to bear social rather than individual meaning, i.e., the product of creativity is compared with the results produced by the efforts of other people, rather than with the knowledge accumulated by a subject prior to his creative endeavors. Says Hargreaves: "An 'original' person is usually regarded as one who has thoughts and ideas that do not occur to the majority; i.e. ideas are 'uncommon'" (177, 2).

However, this view of novelty is also open to criticism. Robert B. MacLeod holds that "much that is novel is utterly trivial" (210, 187). Sarnoff A. Mednick and Martha T. Mednick said the same in a much more categorical form: "Originality is probably the cheapest response of which human beings are capable. It is much more difficult to be conventional than to be original. For example, if you pose the problem of how much is $4 + 4$, I could answer 1,367,854. I doubt that anyone in the world has ever given this answer before. Thus it is extremely original. However, it is not creative unless it serves some purpose or satisfies some criteria" (215, 67)*. Obviously, the difficulties that confront many authors in defining creativity through novelty have necessitated the use of value as the second indispensable feature of the results of phantasy (therefore, creativity) in parallel with novelty. L. Welch, for example, defines the original as "the valued product of this activity, [which] in part or in whole, cannot be attributed to anyone else" (273, 141).

Noticeably, in their striving to overcome the difficulties obstructing the definition of phantasy (creativity), psychologists were gradually moving farther and farther away from the psychological issue and replacing it with epistemological, aesthetic and other problems.

The definition of phantasy (creativity) through its results

* This argument, however, evokes objections because the Mednicks use a question which requires a conventional answer, thus any creative approach to this question is excluded (190, 3).

which are to meet certain non-psychological criteria (novelty and value) are, in our opinion, incomplete and one-sided. Such definitions narrow down the object of our investigation since they do not reflect any activity other than that which may be considered successful on the basis of various, essentially arbitrary judgements. At the same time, true understanding of the internal mechanisms of imagination necessitates a study of all available facts of this phenomenon.

The essential prerequisite for making an adequate definition of a concept is its juxtaposition with various affiliated concepts in order to introduce a more pronounced distinction between them. It is even more important to differentiate between current concepts that partially or completely overlap. Along with the terms "phantasy" and "creativity" the phenomena under consideration may also be designated by the terms "mental activity", "problem-solving", "intuition", "creative thinking", and "heuristics". Some authors have even coined their own terms such as "synectics", "sceptosiology", etc. These terms are sometimes interpreted as equal, hence used as synonyms. Guilford, for example, contends that "in their intellectual aspects, creative thinking and problem solving are regarded as one and the same..." (170, 455). According to Gilbert Ryle, the attribute "mental" is occasionally used as a synonym of "imaginary" (242, 117).

Although contemporary problems of creativity have much in common with the problems of phantasy, the notions "phantasy" and "creativity" are far from being identical. In the broad sense of the word the notion "creativity" includes numerous problems that lie beyond the framework of the psychological problems and belong to sociology, aesthetics of fine arts, history of science (these include socio-historical prerequisites, the significance and value of the products of creativity; the role of traditions in creativity; the interdependence of creative schools and trends, the organisation of creativity and prognostication of its trends of development etc.). We believe that the study of phantasy should not extend beyond specific psychological problems, that it should be confined to research into the laws of the psychological activity which may not be regarded as a mere reproductive effort (in this sense, we may define phantasy as *productive* mental activity as opposed to its reproductive counterpart, or, to be more exact, as opposed to the process of reproducing or recurring the information obtained by the subject). This definition is naturally highly general, yet at this particular stage of our study it enables

us to circumscribe the facts and problems that require investigation.

All this points to the difficulties we may encounter in making a distinction between the concepts "phantasy" and "thinking", since some authors introduce into the concept of "thinking" the sense which we associate with the concept of "phantasy".

Obviously, the difficulties arising from an attempt at drawing a line between thinking and phantasy are stipulated by the fact that even though various textbooks on psychology treat these processes as two different entities, in reality they represent *one mental activity*. Long ago Wilhelm Wundt was strongly criticized for broadening his definition of thinking to include phantasy as its specific form (279, 548). In contrast to Wundt we assume the unity of thinking and phantasy and regard thinking as a specific case of phantasy, identifying it with that kind of mental activity which involves the observance of logical principles and rules. Such a differentiation of the terms "phantasy" and "thinking" does not, as Soviet psychologist A. V. Brushlinsky asserts, lead to the "extinction of psychology of thinking as a science" (190, 342). The psychology of thinking still deals with such problems as the building of various forms and methods of thinking (judgements, deductions, proofs), problem-solving, construction of beliefs, and others.

As is implied by our definition, there is a real multitude of facts in which phantasy manifests itself; these include the earliest products of children's word coinage, their drawings, versifications, original fairy tales, jokes and witticisms, solutions to riddles, technological inventions, scientific discoveries, new plots for fiction literature, unconventional architectural projects, masterpieces by great composers and painters, cartoonists' boons and photographers' breaks, pearls of rhetoricians' eloquence, surprising military stratagems, etc.

It explains why any attempt to limit the activity of phantasy to its particular manifestations will always be treated as an impermissible narrowing of the scope of its problems. Thus, according to some psychologists, the whole activity of creativity is reduced to advancing hypotheses in the process of problem-solving, or to formation and reformation of goals (207, 132), or to anticipating the future (123, 98). An unreasonably limited view of phantasy may also be found in the assertion deriving from Cartesianism according to which phantasy is attributed to sensuous cognition rather than to thinking itself (9, 343). In criticizing this one-sided view of phantasy O. K. Tikhomirov emphasizes that "science fiction does not contain only images

and representations, but it also involves definite concepts, principles, etc." (91, 145). In other words, by reducing phantasy to representations only we have to come back to the dualist juxtaposition of the imagery and conceptual ways of cognition which we have almost overcome. In his book on imagination L. Dugas asserts that "there may be no objects to which phantasy is inapplicable; all conceptions of any order, whether sensible psychological, abstract or general, will serve as its material in equal measure" (143, 173).

In discussing the "internal representation" viewed as a "system of images" used by man in solving problems and during other mental procedures, A. Newell, J. Shaw and H. Simon emphasize that "often, the term image is used somewhat more narrowly to refer to those representations that correspond to one or another of the sense modalities ... visual images, auditory images and tactile images, but we would not, in this narrow usage, speak of 'abstract images'—i. e., representations and processes not used to represent any of the sensory inputs" (221, 102-103). We are not dealing here with the nature of representations and images. Nonetheless, in outlining the problems of phantasy and in trying to avoid any misunderstanding we would like to make the reservation that we regard the visual, imaginal mental activity as a possible form of the process of phantasy which also involves other psychic processes and entities.

Works of numerous modern researchers contain the idea that creativity is something universal. L. S. Vygotsky was absolutely definite in asserting that "in our daily life, creativity is an indispensable precondition for existence" (99, 8). V. E. Anderson believes that "a person can be creative in his social relations, in his ability to deal with others, in his thinking and experimentation in any field of knowledge, in the realm of ideas, as well as in music, art and literature" (108, 81).

By accentuating the role of innovation in productive mentality, H. G. Barnett is equating the concepts of innovation and invention since, in his opinion, "there is no psychological distinction between the conception of a new object and a new act or theory" (115, 8). This standpoint implies that "it is fruitless to try to establish a rigorous and meaningful distinction between 'discovery' and 'invention'" (115, 8).

According to Soviet psychologist V. N. Pushkin: "The psychological process which contributes to the solution of a problem, to the adoption of a new strategy, to the discovery of something new has to be referred to as ... heuristic activity... A science

which is concerned with the study of the laws of the heuristic, creative activities of man may be named heuristics" (51, 4-5). Consequently, heuristics is dealing with the same scope of problems which are embraced by the term "creativity" or referred to as "phantasy". The author of these lines takes an analogous approach to the subject of heuristics in his book *What Is Heuristics* (56, 7-8). Nonetheless the term "heuristics" is infrequently used with a different, narrower meaning: there are a number of works that treat heuristics as "any principle or device that contributes to the reduction in the average search to solution" (221, 78). We may find a similar interpretation of this term in the works of Soviet psychologists (92, 26). Moreover, the epithet "heuristic" is utilized in this strictly technical sense even by psychologists who identify heuristics with "a science of creative thinking".

With due consideration for the additional meaning contained in the term "heuristics", we will employ in this work the traditional term "phantasy", incorporating into the scope of its problems all the psychological aspects which have been revealed by the latest investigations into creative, heuristic activity, i.e., the activity which is conditioned neither by accumulated skills, nor specific instructions, nor the algorithms adopted by the person concerned. Figuratively speaking, as a result of the process of phantasy we obtain at the output a product which may not be completely equated with what we fed to the input. The purpose of the theory of phantasy is to explain the nature and the intrinsic laws of this phenomenon.

Chapter II

THEORETICAL CONCEPTIONS OF PHANTASY

The experimental study of phantasy was often preceded by theoretical conceptions which thus determined the areas of investigation. The views expressed by Lucretius Carus (see Introduction) ranked among the earliest conceptions of imagination. They implicitly contained ideas of analysis, synthesis, and recombination which became the focal point of some other psychological systems.

The opinion that phantasy merely combines usual conceptions in an unusual way and creates nothing new in principle also derives from Lucretius' views. This essentially empirical standpoint was most consistently developed, first, in Hume's philosophy and then in associationist systems.

The philosophy of rationalism recognized the reality of phantasy (imagination), yet, saw it as opposed to conceptional and logical thinking (reasoning). Remarkably enough, Pascal, the famous physician and mathematician, actually regarded phantasy as a force hostile to reasoning.

In almost all his philosophical works Descartes juxtaposed rational thinking and phantasy, identifying the latter with the source of delusions and erratic deductions. For example, in his *Discours de la Méthode* he maintained that "fables cause us to believe in the possibility of completely impossible events" (140, 37).

Spinoza pointed to the necessity of distinguishing "between that which can be understood but not imagined, and that which can also be imagined" (251, 34).

The views of phantasy expressed by Pascal, Descartes and Spinoza gave use to the view that there is antagonism between reasoning (intellectual processes) and imagination. This opinion also finds a response in some contemporary philosophical systems (195, 16-17).

The attitude toward the nature of phantasy revealed by the

different philosophical or psychological currents is determined by their viewpoint on the activity of the individual. Representatives of extreme idealist systems which endow the subject with complete independence from the objective world regard phantasy as an extraordinary spontaneous creative power. On the contrary, the mechanistic systems where the personality is absolutely passive have no room for phantasy as a specific psychological conception although they do attempt to explain in one way or another the facts that give use to its problems. Thus among the diverse conceptions of phantasy we can first of all distinguish two extreme theoretical positions on the problem of its psychological nature: on the one hand, phantasy is singled out as an independent primordial essence; on the other, phantasy is negated or completely reduced to other psychological processes (reductionism).

PHANTASY AS PRIMORDIAL ESSENCE

Phantasy as a special creative essence manifests itself most explicitly in the works of the idealist philosopher Henri Bergson who advanced in his famous *Creative Evolution* the concept of "élan vital" to explain acts of creativity in the broadest sense of the word. Similar ideas have been expressed in the three-volume work by William Stern who employed such terms as "self-conservation", "self-development" and "self-deployment".

According to Bergson, the main intent of the "élan vital" consists in an urge for creativity. This desire is realized at various levels in animal nature through the complication of forms of organisms and the origination of new species, as well as through the evolution of the nervous system. In man it is realized through creative thinking, intellectual abilities, creative initiative, independence and freedom. Thus, he sees phantasy as deriving from a certain universal, all-embracing force which controls all biological, psychological and historical processes.

We may refer to a great number of authors who sought to explain phantasy using universal philosophical and psychological principles. Theodor Elsenhans, for instance, wrote: "We are following ... a universally accepted supposition in regarding phantasy as an initial (*ursprüngliche*) human capability" (149, 31). Such an approach is also typical of philosophers and psychologists with plain idealist views, as well as of certain researchers who try to furnish a natural scientific interpretation to the phenomena of phantasy. In the latter case they substitute various philosophico-

psychological terms, such as "élan vital", "spontaneity of spirit" (Pradines), "emotional power" (Segond) for their biological counterparts. In his allusion to Whitehead and Lillie, Sinnott maintains that life itself is the anticonservative property in nature (248, 12).

Harold Rugg who is the author of the voluminous monograph *Imagination* arrives at the conclusion that "the tension-system of the organism is the key to the energy of creative imagination. ... Revealing itself in the irritability of protoplasm it is as basic to the science of behaviour as is the concept of motion to the physical sciences" (241, 54).

In his multi-faceted work, *The Act of Creation*, Arthur Koestler places all kinds of creative activity ranging from primitive forms of humor to major inventions and monumental works of art and literature in dependence upon the laws which, he believes, are present already in morphogenesis, neurogenesis and regeneration and upon the so-called actualization of excess potentials, which implies the awakening of the dormant powers and abilities as a result of unusual or exclusive conditions.

In making a detailed analysis of the biological roots of creativity, Herbert Gutman follows such authors as Bergson, Stern, Bühler, Sinnott, Coghill and Read in concluding that the biological substrata of constructive activity are growth and reproduction: moreover, according to Gutman, all organized and purposive protoplasmic activity deserves to be classified as "behavior", while constructive or creative activity simply continues where growth leaves off (171, 6-7).

Therefore, the general biological interpretation of creativity inevitably ends in abstract schematism. Gutman, too, has deduced that not a single problem analyzed by him may be subject to a rigorous experimental study.

Scientific unification must not overlook any detail of the general situation. Any generalization will be senseless unless this condition has been observed. Consequently, the introduction of the notion of phantasy into more general philosophical or biological categories would be fully justified if it were accompanied by a new interpretation of all the established facts and by a more adequate explanation of them, and if, at the same time, it revealed new aspects of experimentation. In reality, general biological conceptions not only fail to prompt new ideas for experiments, but they also disregard the available rich factual material. All this questions their scientific value.

REDUCTION OF PHANTASY TO OTHER PSYCHIC PROCESSES

The other extreme theoretical position in dealing with the problem of the essence of phantasy is, as we have already mentioned, the complete reduction of phantasy to other psychic processes.

In his time Main de Biran asserted that phantasy could not be regarded as a special function because it consisted of two psychic phenomena: comprehension and will-power. P. Quercy believed that the entire scope of the problems of phantasy did not go beyond the limits of the problems of perceptive and intellectual processes (see 123, 22).

As long ago as 1868, J. Tissot wrote: "imagination is composed of four or five faculties: perception, which provides the primary material; memory, which reproduces it; reasoning, which adds to it proportion and integrity; taste or intellectual sensibility, which enables us to experience joy either at the sight of a beautiful ensemble or at its simple conception" (264, 3). Thus imagination (phantasy) dissolves completely in other functions.

Such a tendency is also typical of some modern psychologists. Guilford has many times pointed to the diversity of meanings implied by the concept of "creativity" which includes the concepts of "*Aufgabe*" ("problem"), "set", "determining tendency", "schema", "trial and error", "insight", "search model" and "functional fixedness" (168, 7). Rudolf Bergius maintains that phantasy is an abstract notion used to describe a multitude of various states which might as well be designated by the term "reconstruction of a problematic situation" or by some other terms borrowed from the inventory of Gestaltpsychologie (176, 557).

The tendency for reductionism may be regarded as a response to the romantic idealist interpretation of phantasy and as a fetish made of it in the systems proposed by Bergson and others. The problems of perception and memory seem to have been studied most thoroughly, their methods tested, and their truthfulness, in contrast to phantasy, never doubted. Consequently, although reductionism is ignoring certain specific laws of creativity, it is essentially motivated by a desire to rely on concrete and real data rather than on semi-mystical deep-rooted forces. The fact that reductionism relates evidence from the domain of phantasy to the laws that govern other processes has made it possible to reveal and outline some of its prob-

lems. Among these there is the attitude of phantasy toward reality. By reducing the products of phantasy to perceptive images we have to determine the role of the real world in what imagination has created, since perception is a direct reflection of reality.

PRODUCTS OF PHANTASY AND REALITY

The view according to which phantastic images reveal dependence on reality is based on the materialist principle of cognition: we draw our knowledge from the actual objective world around us.

Authors who described utterly improbable events had in one way or another to rely on real events. Most illustrative in this respect is John Livingston Lowes' book *The Road to Xanadu*, which is an investigation into the ways of phantasy. In his work Lowes made a thorough analysis of Samuel Coleridge's semi-mystical poem *The Ancient Mariner*. Lowes meticulously analyzed numerous materials, including the poet's private notes, and inferred that "the notion that the creative imagination, especially in its highest exercise, has little or nothing to do with facts is one of the pseudodoxia epidemica which die hard. For the imagination never operates in a vacuum. Its product is that fact transmuted" (206, 427). M. Berkenblit and A. Petrovsky (8) also furnished arresting examples of phantasy's dependence upon reality.

The attitude of phantasy toward reality may be highly complex and subtle. René Boirel, for example, associates creativity with exposition the "inventory" of aptitudes which are virtually (obscurely) preset in the very nature and things (128, 65, 80, 187, et seq.). In other words, the very material seems to be offering a choice (a block of marble already contains the figure of Venus).

Yet, in determining the association between the content of the products of phantasy and reality we are only making our first step toward the solution of this problem. We have to admit that the creation of fanciful images has nothing to do with the mechanical copying of reality or its mere imitation. Art historian E. H. Gombrich emphasized in his *Art and Illusion* that the theory dating as far back as the epoch of ancient Greek philosophers, which promoted "imitating the creations of nature", has invariably been disproved by the practice of artists in every part of the world: there are facets in each product of phantasy which may not be explained by

imitation only. For example, one of the zodiacal constellations, Leo, was named so by ancient Greeks: their phantasy "added" the image of a lion to the existing combination of stars, while the same constellation projected to South American Indians the image of a lobster (163, 106). Nonetheless, we have to admit that the two images used by the ancient Greeks and by South American Indians were borrowed from real life: both the lion and the lobster are corporeal objects, yet the association of any specific constellation with one or another tangible object is certainly not the mere copying of reality. It is highly important to bring to the surface the factors that band together the elements assigned by reality, to determine the principle that combines them into a whole, and to find out the conditions that stipulate the concrete choice of elements from that reality, i.e., what causes a sculptor to infer the image of Venus from a block of marble which, according to Boirel, virtually contains it.

THE HYPOTHESIS OF RANDOM FINDS

The simplest answer to the posed problem invariably includes a reference to an accident. There are researchers in the field of phantasy who would explain all creative successes and discoveries by nothing other than a stroke of luck. Works on psychology in English often employ a special term, "serendipity", to denote random creative finds.*

In compliance with the "serendipity" hypothesis the emergence of new ideas is caused either by a random coincidence of several images of perception or by man accidentally coming across certain external factors. M. Kostyleff, a researcher of literary creativity, relates the following fact: "Paul Adam confessed to us that whenever his imagination failed to create the fate of his heroes, he used a set of playing cards as a horoscope, and this suggestion was sufficient for him to design the fates of his heroes" (196, 245).

In his article "The Role of Hunches", Walter Cannon, who is a well-known physiologist, offers a long list of discoveries made, in his opinion, by chance. Among these he places the discovery by Christopher Columbus of the New World, the discovery by Luigi Galvani of electrical phenomena in living

* The term "serendipity" was proposed by Horace Walpole, and it is associated with the title of the fairy tale "The Three Princes of Serendip". The characters of the tale make numerous surprise discoveries in traveling from one place to another.

tissues, Claude Bernard's discovery of the nervous regulation of the blood circulation, and the discovery by Hans Christian Oersted of the magnetic action of electric current. And Cannon adds to the same list his own discovery of the interdependence between the emotional states and functioning of some inner organs. However, he emphasizes that that brain is lucky which has been prepared to make a discovery through former experience. The list of such discoveries made through "serendipity" could be extended.

Those who share this view contend that all such cases of discovery are "simply a matter of being at the right place at the right time" (253, 14). Scientists and scholars often discover something they have not been looking for: thus, Karl Wilhelm Scheele who sought to extract magnesium discovered chlorine though he had been completely unaware of its existence before. Claude Bernard was experimenting to prove that sugar is destroyed by the liver, and suddenly discovered that the latter produces sugar (143, 233).

Although certain authors are inclined to use chance as an explanatory principle, the advocates of "serendipity" have to admit that on the practical plane their theory offers nothing other than a passive expectation of a lucky chance. This makes them emphasize the need to meet such possibility halfway and take every step to increase the probability of a lucky chance.

In his book on mathematical creativity French mathematician Jacques Hadamard asserts that "explanation by pure chance is equivalent to no explanation at all and to asserting that there are effects without causes" (173, 19). J. P. Guilford also contends against any references to an accident as an explanatory principle. He regards it as "antiscience", since such an explanation "stops questions and investigations" (170, 431).

The conception of "serendipity" has been lacking inner organization and consistency from the very start, revealing an eclectic merge of diverse approaches. As a rule it is supplemented by other explanatory ideas: recombination, trial and error, as well as synesthesia.

THE HYPOTHESIS OF RECOMBINATION

The idea of recombination shifts the accent from external stimuli to phenomena occurring in the psyche. In the classical works by Théodule Ribot, as well as in the latest researches made by the Mednicks, Welch and others, the attention

is focused on the recombination of not only elementary senses, conceptions and images but also of principles and rules.

The theory of recombination takes root in the atomistic views expressed by Ancient Greek and Roman naive materialists. John Locke adapted this theory to his system, and it manifested itself as a leitmotif of his *Essay Concerning Human Understanding* in which he confined the basic activity of the human brain to unifying (combining), juxtaposing and isolating (abstracting) ideas. In trying to reduce all its faculties to a certain triune formula, Locke was setting limits to its capacity. This idea was further developed in Hume's agnosticism when it was claimed most categorically that "all our ideas are copy'd from our impressions" (186, 319). Hume's philosophy limits man's cognition to the impressions which man obtains through the sense organs, which fully precludes the cognition of the essence of objects, phenomena and their causations, as well as invention. Spearman dismissed this doctrine with the witty remark that it appears not so much to explain creations, as rather to miss finding them (252, 10).

Hume and Locke's interpretation of intellectual activity influenced the whole empirical psychology, including the conceptions of phantasy. Psychologists of the 19th century never addressed themselves directly to the problems of epistemology, preferring, as a rule, to focus their attention on mental procedures.

The above conceptions caused Théodule Ribot to suggest that the entire mechanism of phantasy operates in several stages: in the beginning, consciousness has to disassociate its different states so as to free individual images from their perceptive bonds, and enables them to recombine; the subsequent regrouping of these states is crowned with an association, i.e., a new combination.

Essentially, this seemingly logical and consistent view is nothing other than experimentally unfounded speculation. Nonetheless, certain contemporary psychological systems have widely adopted the interpretation of phantasy as a purely mechanical process. Characteristically, in 1960 Livingston Welch said: "Recombining implies division, subtraction, addition, and multiplication. This applies in any field of thought. I have seen and remembered the images of a gold watch and a snow-capped mountain. I will now subtract the gold color from the watch and add it to the form of the mountain, resulting in my thinking of a golden mountain, an object that I have never seen" (273, 146).

In his strict adherence to the mechanistic conception of creativity, Welch correlates phantasy with the emergence of new fanciful images of a kaleidoscope. "The larger the kaleidoscope with a greater number of pieces of glass, the greater is the number of designs that may be expected with greater complexity. The more the individual has perceived or the more the material he has collected and the longer he has spent recombining its elements, the better is the chance for a greater number and more valuable recombination of ideas" (273, 142). Other explanations proposed by Welch of the problems of imagination are just as simple. Thus originality may result from the fact that an author or a researcher has experimented with a sufficient number of combinations: if the solution to a problem takes a long time, this only means that it was necessary to examine a great variety of combinations. This explanation brings us back to the earlier behaviorist trial and error conception. Behaviorists, of course, attempted to equate intellectual activity, in particular, problem-solving, with a random, chaotic tackling of various methods of solution. This conception was founded on numerous experiments (first and foremost, those conducted by Ashley Horace Thorndike) with animals, in the course of which the latter either had to find the way to the bait, or open a closed box. The observation of their behavior in a problematic situation suggests that it, indeed, may be regarded as a chaotic trial and error search. However, Gestaltpsychologists (W. Köhler and Max Wertheimer among others) succeeded in proving that problem-solving by animals is determined, primarily, by perception of the relationships between the end and the means leading to it, which sometimes enables one to come up with an "off-hand" solution to a problem, evading numerous selections, trials and errors.*

The conditions for the realization of combinatorial activity deserve special attention. J. Lindworsky was one of the first to point out that "phantasy would be impossible unless the once formed images were fixed in the quality and with the bonds stipulated by the situation in their perception" (204, 136). Hence the conclusion that conceptions should be fluid and "soluble", and capable of combining and interpenetration (204, 137). Henry A. Murray notes: "As basic requirements of creation at all levels I would propose the following: a sufficient concentration within a given region of different mobile or motile entities

* Gestaltpsychologists' views of creativity will be considered in more detail later.

with mutual affinity ... sufficient circulation of these entities (218, 102). Among the conditions for creativity Murray singles out man's disposition to perception or, on the contrary, to the rejection of what has occurred to him or appeared in his field of vision, etc., i.e., evaluation.

Undoubtedly, the given prerequisites for "fancying" have been prompted by reality itself, yet their adoption emphasizes the insufficiency of the theory of recombination since a theory will possess a heuristic power only when it may unequivocally predict one or another effect. It appears that the conception of recombination dissolves amid multitude of additional hypothetical concessions.

An attempt to save the associationist views of creativity is easily discernible in the application of certain psychophysiological laws to the explanation of the discoveries of the new. This involves in particular synaesthesia which implies "the emergence by the action of the given irritant of sensations and perceptions which are alien to it and are attributed to other sensory systems on the basis of their quality" (26, 59). Other examples of synaesthesia include individual cases of color audibility when, say, certain sounds produce specific color images.

Francis Galton was one of the first to pay attention to this phenomenon. He made a detailed description of imagery concomitant to certain abstract and even theoretical notions. Thus, one of the scholars questioned by him related that he mentally arranged all the numbers from one to a hundred in a U-shape, with the figure 50 lying in its bend (156, 83, et seq.). Slosson and Downey provide numerous examples of creative acts based, in their opinion, on synaesthesia: "The humming of an aeroplane might well inspire a modern symphonist... Darwin found scientific reflections stimulated by music; Wagner's sense of the dramatic was heightened by the presence of rich fabrics and colors" (249, 49). Yet, all their observations, no matter how exciting, merely scratched the surface without shedding light on the mechanisms of creativity.

PROBLEM AND SET AS EXPLANATORY PRINCIPLES

The basic flaw of the theory of associationism lies, as we believe, in its explaining all the psychic phenomena by circumstances which occurred in the past; in other words, man's ideas, images and deeds are predetermined by earlier events and

earlier existing and imprinted associations. All this excludes the very possibility of creativity in principle except for the previously considered cases belonging to the phenomena of "serendipity". This explains why the representatives of the Würzburg school (Oswald Külpe, N. Ach, August Messer and James Watt) were the first to come out with an all-round experimental criticism of associationism. They accentuated the factors which operate at the moment of intellectual activity, advancing such explanatory notions as "set", "*Aufgabe*" and "determining tendency".

A line should be drawn here, however, between the Würzburg scholars' merits, as viewed in historical perspective, and the conscious goals of their investigations. This group of psychologists conducted their experiments in the early 20th century when the problem of image stood in the center of psychological problems. The whole psychical mechanism of associationism was reduced to the evolution of images, their transformation, dynamics; man's inner life was conceived as the interaction of images, their fusion, enlivenment, ebbing, etc. The Würzburg scholars, incidentally, conducted a special investigation aimed at proving the legitimacy of reducing the entire content of psyche to images, senses and feelings. These investigations led them to the then extremely original conclusion (since it ran counter to the dominant associationist doctrines) that pure thinking is, essentially, imageless, free of visual images. (Alfred Binet obtained similar results somewhat earlier.)

The negation of the role of images in intellectual activity gave rise to the widespread view that the Würzburg scholars had evaded the problem of phantasy. It would be important to emphasize that they were far from rejecting the system of associationism, but only supplemented it with new explanatory notions which, they believed, were supposed to provide a more adequate interpretation of the experimental facts.

The notion of the *Aufgabe* stands among these conceptions. The Würzburg scholars thought it to be the guiding organizing tendency dominating the motion of associative circuits. The rules of logic are observed owing to the *Aufgabe* and it is the *Aufgabe* that "ensures a definite meaningful row of reproductions" (219, 430).

An *Aufgabe* put by the experimenter or the subject causes the latter to adopt a set or attitude which implies his inner readiness to control the process of selection. The conception of "set" was introduced by Marbe in the beginning of this century. He used it to explain perceptive illusions which were

induced by repeated preliminary perceptions. In Marbe's work the notion "set" was identified with a psychological entity which could not be described in terms of the psychology advocated by Wundt and Titchener, i.e., in terms of sensations, images and feelings. The Würzburg scholars found this fact highly appealing because it supported their conception of the "intrinsic content" of thinking and of the "imageless idea".

Besides, they applied this notion to intellectual phenomena, although previously it had never gone beyond the limits of perceptive phenomena. This enabled them to challenge the limits of the associationist "mechanics of ideas" and to replace the bonds between the content of consciousness by the bonds and relations between the actual condition of consciousness and its preceding and future conditions.

The notion of "set" was still further generalized by D. N. Uznadze and his followers who regarded this notion as the founding principle for the whole psychology of the individual.

Understandably, the notion of "set" in its modern interpretation has considerably changed in comparison with its original notion, yet it was owing to this particular notion that psychologists concentrated on the personal aspect of intellectual activity. Johnson notes that the most essential feature of the set is in its unity and continuity and that there are a number of motives and exciting stimuli, yet there is only one set at any given moment. Thus the notion of "set" effected the first attempt to combine theoretically the intellectual activity with a person's peculiarities.

A number of experiments were conducted by some authors to investigate the role of the set in creativity. Of these, most characteristic was the experiment sponsored by C. Taylor. Graduate students were provided with reading materials, with the set of the first group being to preserve them intact, of the second group, to evaluate them, and of the third group, to improve the materials creatively. The results of the experiment proved that the best results in fulfilling a creative assignment were achieved by the students whose set was to display a creative approach. In this particular case, the set stands forth as a special entity which is not controlled by our consciousness and which operates frequently even against man's will. Hence the notions and conceptions introduced by the Würzburg scholars brought us close to the problem of the unconscious. Nonetheless, by being completely engulfed by the then dominating conviction which identified the psychical with the conscious, the Würzburg scholars sidestepped this issue,

while their application of introspection as a single and exclusive method for penetrating into the essence of intellectual processes was logically founded on the conviction that thinking was a conscious process from beginning to end, which made it fully accessible for self-observation.

The views expressed by the representatives of the Würzburg school were also criticized by the psychologists whose conceptions they sought to supplement with new proofs, as well as by those who further developed their ideas. The latter include the advocates of genetic views of the essence of the psychic, in particular French psychologist Albert Burloud.

Soviet psychologist L. S. Vygotsky wrote that "it is neither the problem (Aufgabe) nor the ideas of purpose implied by it that in their own way determine and regulate the entire course of process, it is rather a certain new factor" overlooked by the Würzburg scholars (98, 155). Dutch psychologist Jonan Petrus Van de Geer was absolutely right in saying that after the introduction of the notion of "problem" containing the idea of purpose, "the question is still open as to what makes the task operate towards *relevant* conclusions, how it is that associations lead to answers which are correct from a logical point of view" (157, 25),

The investigations conducted by the Würzburg school occupy a special place in the history of psychology. In spite of certain contradictions in its conceptions and although some of the problems posed by it have not been resolved, it has realized the first experimental study of man's intellectual activity based on facts rather than on intuitive speculative deductions.

Research conducted by Otto Selz stands close to the Würzburg school's investigations. Otto Selz pointed directly to the distinction between the problem posed by an experimenter and the problem materializing as a tendency in the consciousness of the subject. The matter is that the latter is apt to subconsciously address himself to the problems which the experimenter's assignment does not imply. Selz has proved that there are cases when such a personal problem may be of help to the solution, yet in other cases it may be a hindrance.

Selz's investigations bring us to realize an important methodological principle which has it that the same psychological factor may produce both positive and negative effects. No doubt, all this played a major role in consolidating the view of psychology as an experimental science in contrast to the normative sciences adjacent to it, i.e., logic, ethics and aesthetics.

Selz also offered a new approach to the traditional philosophical

problem of abstraction, imparting to it a definite psychological content. According to Selz, abstraction is an important mental act which is essential in solving various problems. However, Selz failed to elucidate the psychological mechanism of abstraction.

Finally, Selz came up with a new approach to the goals of creativity which he thought to be "supplementing the complex" or "filling the gap", i.e., which were supposed to add the missing links to the available information. Frederic Bartlett expressed similar views of the goals of creativity almost a half century later. Naturally, "supplementing the complex" is also a particular case of creativity, yet the introduction of a new factor into the scope of the problems under consideration seems to frustrate the monopoly of a single factor by posing directly a problem as to the diversity of the goals of creativity.

THE LAWS OF THE FIELD AS EXPLANATORY PRINCIPLES

Gestaltpsychologie is a psychological school which is even more radically opposed to associationism. Its representatives are concerned mainly with perceptive, mnemonic and intellectual phenomena. We will not go beyond the limits of the interpretation of creative processes proposed by Gestaltpsychologists (note that in discussing creativity Gestaltpsychologists avoided the term "phantasy" in the same way as the Würzburg scholars and Selz).

Gestaltpsychologie has two essential peculiarities: first, there is its conspicuous tendency for a holistic approach, i.e., a desire to explain individual phenomena on the basis of the properties of the whole; second, there is a tendency to unify the laws of psychological processes. Essentially, there is every reason to regard these tendencies as progressive, yet, as we will show later, their concrete realization evokes objections.

In describing the behavior of monkeys in problematic situations Wolfgang Köhler offers examples of "creative" acts on this evolutionary level: a monkey uses a stick as means to reach a bait; it builds a complex pyramid out of several boxes. All these acts did not occur in the monkey's former experience, hence they are a kind of invention. Köhler explains these phenomena by reorganization of the perceptive images, otherwise, by the improvement of the Gestalt (an integral psychic image) which was imperfect when a problem situation emerged and which later on was considerably improved owing to the inner laws of the psychic field.

The views of creativity expressed by the Gestaltpsychologists were rendered in detail in Max Wertheimer's *Productive Thinking* which, on the one hand, summarized his experience, and on the other, appeared to be his program. In analysing the results of his experiments and observations as well as the discoveries made by Galileo and Einstein (the latter being his personal acquaintance), Wertheimer emphasizes that in the course of thinking man apprehends the peculiarities of the structure and the demands of a problem situation which cause him to change the situation toward its improvement, and notice flaws, "zones of violation", etc., in relying on the realization of the general, integral picture. This enables him to regroup and expose the structural centers, to realize the role, structural place and significance of mental acts, to apprehend the results of changes wrought in the structural chain of command, and, finally, to reveal the conditions for discriminating and transferring certain features (274, 132, 137, 142).

Wertheimer formulated the following requirements to be met by the people involved in creative acts: they do not have to be constrained by the habits they have developed; they do not have to work mechanically, but must pay attention, first and foremost, to the problem as a whole; they must approach its solution with an "open mind" (without any prejudices); they must determine the interdependence between the structure and the problem, getting down to "its roots" (274, 237). In mental acts Wertheimer regards the posing of problems as the most essential precondition. He emphasizes that it is impossible to make an adequate description of the process of creative thinking either in the terms of traditional logic or in the terms of the trial and error conception which have never posed the question of the prerequisites for mental acts, of their correspondence with a problem situation, and of the force that causes man to adopt one or another guideline for his creative search (274, 238-239). Of special value is Wertheimer's emphasis of the necessity to reorganize the material and rearrange the system of knowledge for achieving a desired result.

The Gestaltpsychologists interpret the laws of creativity as particular cases of the laws of the perceptive field, as a shift from a situation characterized by the presence of structural tension to a situation characterized by a structural harmony. This shift is effected by the dynamics of the psychic field which is mainly referred to as the *Prägnanz* principle, the latter asserting that the field itself is striving for ultimate simplicity and clarity of structure as much as its limits allow it (274,

238-239). Creativity, therefore, is essentially a self-regulatory process.

Wertheimer's conception has a number of deep inner contradictions. First, it is unreasonable to make any demands on the subject involved in creativity as long as the creativity itself and its results, according to his interpretation, are stipulated by the forces of the psychic field, the subject turning out to be an extraneous factor. As K. A. Slavskaya, a Soviet investigator into thinking, acutely observed if the problem itself is striving toward its solution, the "subject's part will be reduced to completely senseless efforts: to something resembling a passionate desire to clarify a problem, etc." (87, 114).

Furthermore, how can it be possible to explain from these positions various negative phenomena in thinking, for example, paralogisms, alogisms, contradictory conclusions, or absence of any solutions? If the inner laws of the psychic field are really intolerable to any "imperfect structures", they should automatically overcome every obstacle.

Especially objectionable seems to be the entire hypothesis of the dynamic structural field which is based on the alleged dynamics of the "self-organizing forces" in human brain inconsistent both physiologically and psychologically. This hypothesis was brought forward at first to explain perceptive phenomena. Then it was mechanically applied to mnemonic and intellectual phenomena. The Gestalpsychologists' assertions about the directed changes of the memory traces have been subject to criticism a great number of times (78). In the course of several experimental series which studied the reproduction of one and the same material we showed that concrete facts disprove the hypothesis of the directed transformation of mnemonic traces (71; 80).

Characteristically, Einstein was not satisfied with the explanation of creative thinking proposed by Wertheimer, which was reflected in a letter written with his usual tact to Jacques Hadamard: "Professor Max Wertheimer has tried to investigate the distinction between mere associating or combining of reproducible elements and between understanding (organischen Begreifen); I cannot judge how far his psychological analysis catches the essential point" (citation from 159, 33).

Two main lines were adopted for the development of the Gestalpsychological ideas in the study of mental activity: all-round experiments aimed at studying various aspects of "problem-solving" and the elaboration of problems of visual perception, in particular, clarification of their role (visualisation).

in mental processes. The first line was realized in the experimental works of Karl Dunker. We have already noted that the theoretical conceptions advanced by Köhler and Wertheimer could not explain erratic phenomena and the absence of solutions. Dunker was trying to fill this theoretical gap by making a detailed analysis of the possible reasons for various hindrances that arise in the search for the correct solution.

Although in his interpretation of the experimental data Dunker referred to the classical Gestaltpsychological conceptions, he has introduced an entirely new notion of "functional fixedness" which holds that the qualities of an object handled by the subject will appear different to him, depending on both subjective and objective reasons. The qualities associated with an object's functional assignment are more conspicuous and fixed, which confines it to strictly specific functions. In order to assign a new function to the object it is necessary to overcome this functional fixedness.

The most important factor in Dunker's work is, in our view, his interest in the negative phenomena of mental acts, which were ignored by early Gestaltpsychologists. His research was further developed by the investigators concerned with problem-solving which is a traditional aspect of the psychology of mental activity. Of special importance here are the views expressed by Dutch psychologist Van de Geer who was one of those who pioneered in making a distinction between open and closed problems (see Chapter III).

In Van de Geer's conception a great role is attributed to the teaching of imaginary situations, which consist of symbols as distinct from real situations, yet correspond to them to a certain extent. Van de Geer placed the main emphasis on the activities of the subject involved in problem-solving. To find a new aspect in the imaginary problem situation, the observer must take a different point of view of it. Yet a new aspect will not show itself all of its own, if the subject is the passive contemplator waiting for what will happen. The subject has to "unfold" the new aspect, he has to "think it out" (159, 133).

Thus, there is an obvious tendency to accept a personality's active role as an essential factor in problem-solving, notwithstanding the simultaneous adoption of the Gestaltpsychologists' laws of the psychic field. In his thinking a person elucidates an object's various relations with other objects of thought in the same way as a subject may perceive his object's various facets in regarding it (159, 134, 201-202). And although the "unfolding" of the object of thought takes place in an imaginary field, the latter is invariably

connected with the reality. Consequently, imagination derives essentially, from a subject's interaction with the reality around him. The notion of "structural field", too, played a great role in the works of French scholars Boirel (129), Vidal (268) and Rouquette (239).

The line of investigation developed by Dunker and Van de Geer proves that for explaining experimental facts the researchers had to adopt radically new ideas which in many ways ran counter to the traditional Gestaltpsychological conception of creativity.

Another tendency which also takes root in the Gestaltpsychological views and which has visualization as its founding principle may be regarded as a certain return to the orthodox views shared by Köhler and Wertheimer. The most remarkable representative of this tendency, Rudolf Arnheim, is the author of several books on art and creativity, among which his fundamental book *Visual Thinking* (1970) deserves the greatest attention as it focuses on the problems of creativity. In this work Arnheim has made an attempt to substantiate his thesis on the unity of the laws of thinking and perception and of the leading role of visualization in creativity. Arnheim does not base his conclusions on experimental or clinical data, but relies on the vast literary material; he has used various works by philologists, art critics, physiologists, historians of mathematics, cyberneticians, and specialists in the sphere of automatic reading devices, etc.

"Artistic activity," Arnheim writes, "is a form of reasoning, in which perceiving and thinking are indivisibly intertwined.... The remarkable mechanisms by which the senses understand the environment are all but identical with the operations described by the psychology of thinking. Inversely, there was much evidence that truly productive thinking in whatever area of cognition takes place in the realm of imagery" (111, V).

Essentially, this idea is neither novel nor original. Way back in the early 40s Susanne K. Langer wrote in her *Philosophy in a New Key*: "Unless the *Gestalt*-psychologists are right in their belief that *Gestaltung* is of the very nature of perception, I do not know how the hiatus between perception and conception, sense-organ and mind-organ, chaotic stimulus and logic response, is ever to be closed and welded" (200, 90).

Arnheim has closed the hiatus rather easily. In his opinion, the perceptive mechanisms perform "active exploration, selection, grasping the essentials, simplification, abstraction, analysis and synthesis, completion, correction, comparison, problem solving, as well as combining, separating, putting in context" (111, 13).

Seemingly, it is difficult to add anything to the listed creative operations, with all of them being active already on the level of perceptions.

In singling out the visual perceptions from all the other types, Arnheim emphasizes that while the solution of any problem suggests a reorganization of a problem situation, this procedure is very simple in the case of visual perceptions: sometimes it may be effected by a mere shift of the center of orientation. The visual perceptions are invariably characterized by closing hiatuses which is a phenomenon typical of intellectual behavior; problem-solving is also fully comparable with the perceptions because in both cases an important role is attributed to grasping conspicuous features, organising data, and changing accent in their relationship. Finally, Arnheim has made an especially detailed analysis of abstraction which, he believes, not only presents itself in perceptions, but also, owing to them, becomes possible (this aspect is discussed in detail in Chapter V).

Arnheim is fully consistent in his one-sided interpretation of creative phenomena. He asserts the enormous superiority of the visual method ("visual medium") over the other ways of cognition (111, 232); he associates the cosmological conception of the shapes of the planetary orbits with the initial "simple" Gestaltpsychological circumference manifesting itself even in children's drawings (111, 275-277); he believes that a visual analysis of the "Pythagorean figure" may be sufficient to prove that the square of the hypotenuse equals the sum of the squares of the two other sides (111, 224); in ascribing the creative tendencies to all instances of the mind, he has made a surprising conclusion that "the human brain is not suited for mechanical reproduction" (111, 298). There is hardly any need to prove the inconclusiveness of all these assertions. Suffice it to consider just one example in order to disprove theoretically Arnheim's conceptions. Arnheim maintains that it is difficult to perceive the fact of Earth's attraction "because no sensory experience suggests this interpretation" (111, 59). Yet, Newton's discovery runs counter to the perceptive data, which puts Arnheim's example in conflict with his own theory.

In a number of researches, contemporary psychologists have been focusing their attention on the problem of visualization, although they interpret it differently. Thus, according to the theory advanced by American psychologist L. E. Walkup creative personalities proceed from accidental discovery of their ability to visualize to its consummate development, which facilitates greatly the operations entailed by thinking. Consequently, visualization stands

forth as a method ensuring efficient mental rearrangement of the available information. This brings us back to the associationist conception of recombination.

Newell, Shaw and Simon have made a highly realistic and objective assessment of the role of visualization in a creative process: "Often we deliberately construct visual representations of abstract relations... For example, when we represent something as an arrow, we determine the order in which the items connected by an arrow will be called into attention... If we represent something as a line, we are likely—because that is the way our visual imagery operates—to impute to it the property of continuity.

"Herein lie both the power and the danger of imagery as a tool of thought. The richer the properties of the system of imagery we employ, the more useful is the imagery in manipulating the representation, but the more danger there is that we will draw conclusions based on properties of the system of imagery that the object represented doesn't possess" (221, 101-103).

In our opinion, this assessment of the role of visualization for creativity proves the groundlessness of various claims expressed by those psychologists who identify visualization with a theoretical conception which can reveal the nature of creativity. If we regard visualization as a concrete practical method of mental activity, we find that in a number of instances it will undeniably contribute to creativity along with some other methods (for example, analogies). At the same time, the use of the notion of "visualization" as an explanatory conception creates serious theoretical difficulties and calls for additional assumptions, as is, for example, the case with the hypothesis of recombination.

As we have already noted, there are a number of contemporary representatives of the Gestaltpsychologie who supplement the orthodoxal hypotheses of the "psychic field" with other assumptions, thus showing a lackadaisical approach to the theoretical interpretation of data.

The psychologists who seek to combine Gestaltpsychologie with associationism, in particular, claim that the insight does not always have to precede a solution, but it may either coincide with it or even follow it. This may suggest that the insight is nothing other than a ready result of the behaviorist trial-and-error mechanisms, although they take place beyond the threshold of consciousness; it is for this reason that we experience insight as an unexpected illumination.

The tendency to supplement the Gestaltpsychologists' traditional theory with various conceptions borrowed from other, at times,

polar, psychological systems offers every proof that even the advocates of Gestaltpsychologie come to realize the inadequacy of their premises.

HYPOTHESIS OF STAGES OF CREATIVITY

The conceptions which seem to compromise the idea of trial-and-error and the idea of insight can be seen in the hypothesis of the stage character of creativity. The latter, no matter how shapeless, was advanced by the early researchers into imagination and thinking.

In 1909, American philosopher and psychologist John Dewey published his book *How We Think* in which he divided creative thinking into five stages. In the beginning, man has to *identify* his problem or pose a question. This leads to the *analysis* of the problem, its more accurate definition and its juxtaposition with other problems. Then comes the stage of *advancing hypotheses*, examination of various assumptions which may help solve the problem. The next stage involves *discussion* and estimation of likely conclusions and consequences evoked by the hypotheses, and decision-making. In the final stage, the *evaluation of decision* is effected through experiments and other tests.

Undoubtedly, this scheme embraces the principal stages of creativity, although it is characterized by a considerable degree of generalization. It may be applied with equal success to either minor practical problems or to the problems to be solved by a number of scholars within a number of years. As regards the psychological essence of Dewey's theory of the stages, its inadequacy manifests itself most conspicuously when compared with the later conceptions of stages in creativity.

All these conceptions were greatly influenced by the scheme proposed by Graham Wallas in his *Art of Thought* (271) where he singled out the following stages of creativity:

1. *Preparation.* At this stage a person culls all the necessary information and addresses himself to various aspects of the problem.
2. *Incubation.* At this stage a person does not deal with the problem consciously.
3. *Illumination.* This stage involves a person's illumination with "a lucky idea" accompanied with corresponding mental states (a feeling of accomplishment, joy, etc.).
4. *Check.* At this stage a person reconsiders the authenticity and valueness of the new idea.

Even though Wallas' scheme contains fewer stages than that

proposed by Dewey, it, nonetheless, includes the stage of incubation which was overlooked by all the preceding scholars. Wallas did not limit his scheme to a mere re-arrangement (or regrouping) of the relevant facts, but he included in it an essentially new and important psychological observation: the solution of a creative problem suggests a certain departure from it and even its conscious oblivion. We may come across descriptions of similar phenomena by various scholars. Poincaré, for example, described his "illumination" during a geological expedition when he was absolutely disinterested in the mathematical problems he had been previously concerned with. Russian writer V. G. Korolenko had this to say on that matter: "I don't write much, and, which is essential, I cannot control my imagination to the extent needed to force myself to write when I have to... There are cases when I succeed at once ... yet sometimes I have to wait for a long time for the inspiration to come. At such moments I put off my work until the leitmotif is resounding in my soul" (25, 24-25).

C. Patrick sought to confirm Wallas' hypothesis of the four stages of creativity in her experimental researches into the productive activities of poets, artists and scholars. At the same time, she had to admit the probability of their bias. Incubation, for instance, often runs in parallel with preparation (the first stage), while the stage of check is likely to coincide with the stage of illumination. Patrick believes, in particular, that an increase in the incubation stage brings about quantitative and qualitative improvements in ideas.

What explanation was offered to the incubation period? Poincaré maintained that hiatuses between conscious acts of thinking were filled with subconscious mental activities. Helmholtz wrote about the necessity of pauses in mental activities for they, he asserted, had to alleviate fatigue. Woodworth associated the positive effects of incubation with the absence of fatigue and interferences, as well as with a possibility of "getting rid of false leads and hampering assumptions" (278, 823).

The explanation of incubation proposed by Richard P. Youtz is permeated with the spirit of mechanistic associationism advocated by Hull. According to Youtz, "the problem-solver, although unaware of it, was trying out many possible solutions" in the period of incubation, producing "novel tentative assemblies" (280, 197).

Of special interest are the explanations of incubation proposed by Patrick and Hilgard. Patrick believes that the time interval creates conditions for a new approach, new set, for the application of a new strategy, while Hilgard contends that the time serves

to relax the fixed set described by Dunker (see above), which obscures new possible solutions.

However, it has not been possible up to now to obtain any experimental data establishing the duration of the set and of the functional fixedness; moreover, the theoretical interpretation of these factors offers no conclusions about their duration. Therefore, we cannot accept the above-mentioned explanations of the effect of incubation either.

At present, literature on psychology abounds with various schemes of the stages of creativity. The comparison of these schemes proposed by numerous authors—their most complete review being offered by J. McPherson—reveals the diverse character of these schemes. There are schemes (e.g. that of Wallas) which are aimed at showing the natural course of a creative process, while others (similar to that of Dewey) do not extend beyond purely organizational instructions for creative workers. Characteristically, the latter schemes normally omit the incubation stage which, understandably, may not be confined to a framework of certain requirements. As regards the concrete content of each stage, the authors give preference to the earlier schemes, changing them infinitesimally, i. e., either combining several stages into one (thus, Johnson's three-stage "problem-solving" scheme incorporates two stages of Wallas' scheme), or vice versa, splitting a single classical stage into several minor components, amplifying, for example, the substages such as "comparison of the existing with the desired", "limitation of the problem", etc. (F. Vidal).

The teaching of the stages continues to be subjected to criticism. Thus, J. E. Eindhoven and W. Edgar Vinacke (269, 99) maintain that the basic flaw in the teaching of stages lies in the fact that they are essentially introspective and are effected only under laboratory controlled conditions. In relying on their own results, Eindhoven and Vinacke maintain that there is not a single convincing proof to support the presence of Wallas' four distinct stages. They suggest that these facts be interpreted as different aspects of a creative process rather than stages as long as they are intertwined so tightly. Some other authors (including Patrick) have noted overlapping of individual stages. And Guilford was right in emphasizing that the evaluation or the check (the final stage of Wallas' scheme) may take place earlier and that its appearance only at the very end of the whole process is unjustified (170, 444). Later on we will try to prove the essential role of evaluation in creative processes.

Nonetheless, the teaching of the stages of creativity has revealed the important role played by incubation in the process of creativity;

even without any acceptable explanation of it, incubation, undeniably, stands forth as a real experimental discovery. It has enabled us to verify further the range of problems to be investigated in the future by making an inquiry into the role and place of evaluation in creativity. All this proves the plausibility of the hypothesis which divides creativity into stages even though it has not provided us with a solution to many problems associated with this hypothesis.

ANALOGY AS AN EXPLANATORY PRINCIPLE

We have observed that the hypotheses advanced to explain phantasy and creativity reveal the tendency to reduce all these processes to "non-creative" acts, i. e., to random discoveries, perception, synesthesia, etc. Analogy is even a more subtle and veiled form of such reduction. The principle of analogy precludes any derivation of the products of phantasy directly from perceptive images, while associating them with these images indirectly, by implication, and by introducing the notion of similarity.

Various psychologists have traced the influence of analogy in allegories, comparisons and, especially, in metaphors which are most characteristic of literary creativity, and whose role in word-building and in the formation of various figures of speech may not be underestimated.

Charles S. Spearman was most categoric in accepting analogy as an explanatory principle of phantasy. In his *Creative Mind* he contends that the utmost degree of creativeness which the human mind can under any conditions possibly attain consists in its ability to transfer one or another relation from one object to another (252, 26). According to Spearman, the revelation of similarity lies at the foundation of all the facts of creativity. Thus, the heliocentric system created by Copernicus would not have been possible if he had not applied the circular motions observed on the Earth to the celestial bodies, i. e., to the sphere where these motions were not observed directly. James Watt would not have invented a steam engine if he had not been observing the motions of the lid on a boiling kettle. In devising his principle Archimedes proceeded from noticing the reduction of his own weight submerged in water; then he transferred his observations to all the submerged bodies. Benjamin Franklin established the affinity between the lightning and the phenomena observed in an electrical machine. Besides, Spearman uses analogy to explain the discovery by Isaac Newton of the law of gravitation (by finding the affinity between falling of an apple and attraction of the

celestial bodies) and the discovery by William Harvey of blood circulation (by comparing pump valves with veins), etc. (252, 99-109).

In his enthralling book *Où vivrons-nous demain?* (Where Shall We Live Tomorrow?) Michel Ragon describes next to improbable projects of future cities. His project of a city built on the sea resembles a giant sea-weed. His other projects of apartment houses and urban arrangements have been created by way of analogy with flowers, automobiles, bubbles, etc.

There is no denying that analogy plays an enormous role in literary creativity. For example, the sight of a single bush on a ploughed field inspired Lev Tolstoy to write a long story about Khadji-Murat. And finally, analogy is certainly important for the solution of theoretical problems. A. Einstein and L. Infeld convincingly proved in their popular work *The Evolution of Physics* that a number of scientific physical conceptions had emerged as a result of analogy (148, 39). For instance, analogy was used as the foundation for advancing a substantional theory of heat which was rejected some time later, however.

The sound and light wave theories also materialized as a result of analogy with the wave propagation in liquid media. A number of psychological hypotheses of forgetting are nothing other than tangible analogies. Thus, George Müller has identified oblivion with erasing inscriptions, while Sigmund Freud was plain about the presence of censorship in human psyche, which bars the "prohibited". Advocates of the reproductive inhibition conceptions picture human memory as a book-case in which one's access to old books is becoming more and more obstructed as new books are filling its interior.

The abundance of examples seems to prove that analogy explains phantasy and creativity. Yet a number of facts and theoretical assumptions hinder the acceptance of this conception. To begin with, there is hardly any creativity in the works that have been produced on the basis of analogy with any pattern no matter how refined. As regards the genre of parody, its peculiarity, in particular, lies in the fact that it attributes to analogy but a secondary, subordinate role, while a new surprising idea appears in the foreground, and there may be no analogy in its origin.

What is more, there is a number of discoveries made in defiance of analogy, the latter leading a researcher astray. Study of the nature of heat phenomena (see above) proved that analogy offered to the researchers an utterly erratic direction. In following Hebb, Peter McKellar points out that penetration into the nature of light presented physicists with enormous

difficulties because they failed to find a compatible analogy.¹ The whole argument between the opponents was reduced to the problem whether light was "like a shower of pebbles" (corpuscular theory), or it was "like ripples in a bathtub" (wave theory). The correct answer that light combines both was hard to find, because there was nothing in the researchers' experience that had the properties of both (214, 75). However, in spite of the absence of any feasible analogy, Einstein managed to furnish the correct answer.

Now we would like to offer the main proof that ultimately precludes explanation of phantasy by analogy. Analogy may not be regarded as an elementary, primordial psychological mechanism, since it implies a correlation of at least two phenomena. Natural questions arise: what are the grounds for making analogies? How far can they extend? H. G. Barnett made an attempt at answering these questions in his *Innovation*. He maintained that in his creativity man has to discern the relationship between parts of one "configuration" and then to transfer it on the parts of another configuration (115, 188). In his analysis of the reasons for "cross-referencing" the existing configurations by analogy, Barnett touched upon a highly important theoretical problem. If a part of one configuration is identical with a part of another configuration, then, he says, we would have every reason to cross-reference these parts, which would hardly add any novelty to the result, yet in order to achieve a certain new result, the cross-referenced parts should "form a new configuration with properties distinct from those of either of the two pre-existing wholes". This brings us back to the legitimacy of such a cross-reference since it may not be effected unless the two parts are identical.

What does Barnett propose as a means for overcoming the "vicious circle" described by him? He says that "we are constantly equating the data of our experience by overlooking the differences which inevitably occur among them... Our common treatment of the many different objects that we call pencils means that we ignore the innumerable variations among them and disregard the quantitative and qualitative changes that they individually undergo by the minute and the hour..." (115, 191).

Here Barnett approached one of the most essential, in our opinion, problems of mental acts: clarification of the significance of evaluating factors. Yet, no sooner had he made his minute step toward the recognition of the role of evaluating factors, than he came up with a logical scheme of selecting the common factor, emphasizing that a whole of one configuration is equated by a whole of another configuration on the basis of their

partial similarity. In reality, however, he failed to overcome the tautology he had discovered himself: similarity is determined by—similarity!

All this indicates that in trying to explain phantasy by means of analogy we are far from revealing the laws of creativity. Some authors try to supplement the hypothesis of analogy with other assumptions.

THE HYPOTHESIS OF RECOGNIZING CREATIVE IDEAS

Among such assumptions stands the hypothesis of recognizing creative ideas. It implies that in the course of creative activity we have to examine a multitude of external impressions in order to select those matching our specific assignment, to find the needed analogous situation, or, to be more exact, to recognize everything that may come in handy for the solution of a problem in the available objects, phenomena and their relationships.

Henry Eyring speaks about a special faculty for recognizing an analogy, emphasizing that this faculty "resembles the ability to recognize a recurring musical theme running, with variations, through a composition" (150, 4-5). Meanwhile Mary Henle pointed out that "if we are not receptive to our creative ideas, they will not come" (181, 40).

The notion of recognition was, as is known, borrowed from the arsenal of concepts associated with mnemonic phenomena, in this sense recognition presupposing a recurring perception. It would be nonsensical to speak of recognition of an object of which the subject has no information, or at least some basic knowledge. In applying the notion of recognition to phantasy (creativity), we, naturally, may inquire what are the "original images" or basic meanings.

Yet, if we admit the presence of such "basic knowledge" in psyche, we also would have to admit that the solution is not new. The only conceivable way out of this theoretical impasse is the assumption that there is but little in common between the basic knowledge and the initial data. However, this assumption automatically brings us back to the problem of similarity and analogy, to the solution of which psychologists were applying this particular hypothesis of recognition.

Is there any sense in discussing the recognition by a composer of a symphony which he has not composed, or by a poet of a poem which he has not yet written? In such situations, it is utterly illogical to talk about "recognizing the finale"

(V. N. Pushkin), which may only be the crowning result of creativity; while with this result ready at hand, it would be needless to create what has already been created. In the same way whenever we have to discuss a discovery of a new solution, we may not rely on an "earlier situation", since this would be running counter to the very idea of discovering an essentially new solution.

V. N. Pushkin had every reason to emphasize that "recognition is as much a component of a game of chess as it is an attribute of any other complex heuristic process. It is a reconstructive or ... reproductive form of the intellect. There is also ... creativity proper, aimed at modeling conditions of an assignment and building new, previously unknown, operational information systems" (51, 210-211).

Thus, the recognition hypothesis can be only applied to solve standard problems and not to explain the creative acts involved in producing something new. And the fact that the hypothesis of recognition has proved to be theoretically untenable fully precludes its use for supporting the hypothesis of analogy, as was proposed by some psychologists. The hypotheses of analogy and recognition reveal further development of the early associationist views according to which phantasy was limited to a mere imitation (analogy being, essentially, an indirect form of imitation), or to past experience (any act of recognition being a recollection of the past).

THE PSYCHOLOGICAL ASPECT OF THE PROBLEM OF ANALYSIS AND SYNTHESIS

We have already pointed out that in the opinion of sensulists and early associationists the concepts of dissociation and association (integration) of psychic material played an important role in mental activity. And while Locke spoke about the "separation" and "combination" of ideas, Ribot who advocated the conception of recombination was convinced that the groundwork of phantasy was made up of the mechanisms of "dissociation" and "association". The conceptions of diversification and unification have entered philosophical and logical systems because each time we deal with concepts and judgments (such as definitions, classifications, etc.) we have to establish either their distinction, or, vice versa, their affinity.

I. M. Sechenov regarded the processes of analysis, synthesis and generalization as transient means for passing over from sensuous to intellectual cognition (85, 537).

Pavlov's teaching defined analysis and synthesis as universal

forms of activity inherent in the nervous system. He asserted that "the analysis and synthesis of the conditioned reflexes (associations) are essentially the same main processes occurring during our mental acts" (45, 335).

Analysis and synthesis lie in the focal point of the views of thinking shared by the prominent Soviet psychologist S. L. Rubinstein, who maintained that the intrinsic conditions of thinking should be identified with the laws of analysis, synthesis and generalization. Yet, this premise cannot but question the legitimacy of considering these particular notions in terms of laws (analysis as a law, etc.), or suggest that there may be some other laws to explain them. Some of his remarks certainly imply that the latter was very much in line with his views. Thus, S. L. Rubinstein's posthumous theses of one of his reports pose a highly explicit problem: "What causes and compels us to analyze and transform the initial conditions and requirements?" (82, 226). Obviously, analysis is here hardly conceivable as an objective law; it is not even identified with any form of activity, but is rather regarded as an objective which is not easy to attain.

The investigations conducted by A. M. Matyushkin, Rubinstein's disciple, proved that the required analysis does not occur automatically and that special conditions have to be produced to bring the subject to it.

All this leads us to the conclusion that such notions as "analysis", "synthesis", etc., may be applied to the description of concrete intellectual acts and the concomitant results, yet they fail to explain the process itself. Consequently, we have to make a distinction between the intrinsic laws and the accomplished activities, the character of which varies depending on the assignment. For instance, analysis would be required if we deal with syncretic material; with a diversified character of the phenomena representing the same entity, we would have to resort to synthesis. Whenever different qualities of an object are received by the subject as an integrity (e.g. heat and temperature), the correct process of their cognition would ineluctably presuppose their division, separation, analysis; while on the other hand, a penetration into the common essence which manifests itself in individual facts (say, in falling of objects and revolution of planets around the Sun) is based on their unification, synthesis. Yet, the psychological problem lies in determining the ways and means for achieving the desired results: before conducting analysis or synthesis we have to decide which of the two actions is to be performed. A number of psychologists concerned with the study of creativity came to that conclusion. M. G. Yaroshevsky, for example, writes: "The psycho-

logical characteristic of thinking *per se*, in contrast to its objective content, was, according to S. L. Rubinstein, confined to the operations of analysis and synthesis which are extremely formalized logical concepts. This brought to naught the specifically creative element of thinking" (103, 49).

Thus the concepts of "analysis" and "synthesis" borrowed from logic reflect certain results of an actual mental process, though they may not be regarded as intrinsic psychological laws.

THE SUBCONSCIOUS AS A SOURCE OF PHANTASY

All the theoretical conceptions of phantasy that we have considered above identified the primary material of creativity with a set of data inferred from reality, this primary material being the subject-matter for further transformations. However, a number of psychologists have noticed a special reality in the depth of mind which, in their opinion, could also serve as material for phantasy. Such views were expressed by the followers of the psychoanalytical school. Sigmund Freud's teaching was widely popularized, gaining all-round recognition. We will address ourselves only to the psychoanalytical data which bear directly on the problems of creativity.

In examining the causes of neuroses, Freud encountered phenomena which could not be explained in terms of the psychology of consciousness dominating at the end of the 19th century. The adequate explanation of the new clinically obtained facts called for the assumption that the structure of the "mental apparatus" was extremely complex, and that alongside the conscious sphere easily observed by the subject there is another equally real sphere lying beyond the reach of direct observation. This sphere was named "subconscious". We could see that the representatives of the Würzburg school failed to exceed the limits of the psychology of consciousness, identifying the notions "psychic" and "conscious" in volume and content. Yet, a number of philosophers, from Leibniz to von Hartmann, who made a wide use of the notion "subconscious", imparted to this notion a negative meaning, because they discerned in it something lacking the properties peculiar to consciousness. Psychoanalysis seriously probed into the psychological nature of the subconscious in order to determine its content and basic laws.

It is noteworthy that psychoanalysis proceeded from the study of one of the most neglected forms of phantasy, namely, dreams which the psychologists and the physiologists of the past

explained extremely primitively as an accidental side effect of a discharge of the nervous energy in the state of sleep. Freud relied on his meticulous analysis of recollections of dreams to prove that all the elements of a dream, no matter how senseless, incoherent, and absurd, are closely linked with our entire inner life and, hence, have a psychological meaning. Freud attributed to dreams a vital biological function, in particular, of preserving the sleep by way of illusory fulfilment of wishes and illusory elimination of irritants interfering with it (154).

Thus dream images as well as the other fanciful images have quite real sources. However, these sources include not only the external reality but also the inner psychic life which is often unconscious.

The phantasy which manifests itself not only in the dream images but also in works of art complies to specific laws which, according to psychoanalysts, govern the entire subconscious sphere. These include bias mechanisms (a shift of accent from one phenomenon to another, as well as substitution of an unacceptable situation with a harmless one) and condensing mechanisms (a fusion in a single image of several images or their individual features). Special significance is attached to the symbols substituting faces, parts of human body, objects and actions.

According to Freud, the mechanisms of bias, condensing and symbol formation are revealed in any form of phantasy: whether in the weird desires of a neurotic, or delirious ideas of a psychopath, mythological folk fables and religious beliefs, intimate day-dreaming and poetic creativity.

Transition from the subconscious sphere to its conscious counterpart is effected by means of a so-called projection. Erich Neumann illustrated the phenomenon of projection in the following way: "Just as in a cinema projector, a picture behind a spectator appears in front of him on the screen, the contents of the subconscious are projected, at first, indirectly, and perceived as the contents of the outer world and not directly as the content of the subconscious. So, a 'demon' is not regarded as part of a man to whom it appears, but as an entity existing and acting in the outer world" (220, 34). And just as a child who realizes his dreams in the games he has invented, an artist, according to the Freudians, realizes all his endeavors in his works in a veiled form. For instance, Herbert Read, a British theoretician of art, discerned a projection of Coleridge's spiritual conflict in his poem *Dejection* inspired by the poet's sudden passion toward his friend's wife (233, 130-131). Thus, the inner conflicts seem to come to the surface in a shape very much different from that which was inherent in their inner apprehensions.

Naturally, with the consideration that the psychoanalytical conception of imagination is not based on experimental data which ensure highly objective conclusions, some of the psychoanalysis' interpretations are marked by subjectivism and one-sidedness. Undoubtedly, adequate cognition of the process of phantasy involves serious investigation of the core of psychic processes.

We have to emphasize that a mere allusion to the term "subconscious" as an explanatory principle creates but an illusion of an explanation. The term "subconscious" has at least two meanings: first, it serves to denote a special psychic instance or a sphere, which endows it with a topological meaning; second, when characterizing psychological phenomena it points to the absence from these phenomena of a certain property, i. e., accessibility to consciousness. Neither of the two meanings, however, represents a theoretical conception capable of explaining psychological phenomena.

The doctrine of the subconscious enlivened the interest toward the problems of intuition. At the same time, the intuition, to which philosophers (particularly, Bergson) and some psychologists [Malcolm R. Westcott (275)] resorted in order to explain various enigmas of psyche (sudden insight, direct grasping of links, essences, etc.), still remains an obscure notion identified either with the phenomenon of insight [Rouquette (239)] or with the unconscious or the incomprehensible [I. V. Bychko and E. S. Zharikov (11, 224-225)]. Individual aspects of the problem of intuition were exposed in the latest philosophical literature by M. Bunge (10) and A. A. Nalchadzhyan (40).

Quite naturally, the argument about the subconscious, its essence and its interrelations with consciousness is a part of a more general and broader psychological context and extends far beyond the framework of the problems of phantasy considered here. Although many facts obtained by means of psychoanalytical techniques attest to the reality of the subconscious, we have to bear in mind that its idealist interpretation may become a furtile soil for various speculative mystical deductions. A typical example of this is the teaching of Swiss psychologist Carl Gustav Jung, Freud's follower.

THE HYPOTHESIS OF ARCHETYPES

Critics of psychoanalysis chose the "pan-sexualism" of dream symbolics and other products of phantasy as the main target for their attacks. Carl Gustav Jung aimed at creating a more

“respectable-looking” system, for which he radically revised one of the basic notions of psychoanalysis—the libido. In his teaching the libido was seen as some universal “psychic energy”, and the imagery, which was engendered, according to Freud, by real libidinous passions, such as, for example, dreams of sexual intercourse with one’s mother (the so-called Oedipus complex), was interpreted as a desire to relieve the burden of the feeling of responsibility because no one else but mother can instill in a person the state of serene comfort. Thus, a highly complicated emotional form replaces a primitive biological drive. Yet Jung does not limit himself to this: he comes to the conclusion that symbols are inherited in the form of so-called archetypes. Jung and his school even discuss the collective subconscious element, which determines the life and creativity of a person and of whole populations. Jung maintains that symbols and images of phantasy in general are stipulated by archetypes, i. e., by a priori abstract patterns inherited in man’s psyche since his birth and representing “typical forms of apprehension” or a factor determining uniformity and regularly recurring ways of apprehension (194, 281). Some of Jung’s followers come up with suppositions about the probable existence of special anatomico-physiological substrates of archetypes which resemble inherited mnemonic engrams. They are said to preserve the experience of a race acquired through the centuries of its existence (233, 54).

Erich Neumann writes in his *The Great Mother*: “When analytical psychology (Jung’s school.—I. R.) discusses the original image or the archetype of the Great Mother, it does not mean anything concrete existing in time and space, but a certain inner image operating in human psyche” (220, 19). Later, however, we learn that the very image of the Great Mother dates back to its still more ancient archetype of “Uroboros” which was the “symbol of the initial psychic state and primordial situation ... when the positive and the negative, the male and the female were mixed” (220, 33).

Herbert Read makes wide use of archetypes for explaining painting and sculpture. He interprets the characters and details of Picasso’s *Minotauromachie* as a realization of various archetypal images; the bearded man ascending the stairs embodies the archetype of a wise man; the Minotaur, the incarnation of all the dark forces of the Labyrinth, the subconscious; the sacrificial steed symbolizes the subdued forces of the libido (drive), and, finally, the child with a torch is the expression of supreme consciousness (233, 66).

The French investigator of mythology, Claude Lévi-Strauss,

maintains that "each child beginning from its birth possesses forms of structural mental sketches which incorporate the sum-total of means which mankind has been using eternally for determining its relations to the world" (202, 120-121).

Another French investigator of mythology, Gilbert Durand, emphasizes that it would be wrong to derive the symbols from external phenomena. Contrary to that, in his opinion, one must seek to explain the phenomenon of archetypes and symbols only by peculiarities of human psyche (144, 28-29). That would mean that there is nothing essentially new in the creativity of poets and writers and that the best they can do is just vary the inherited primordial images of archetypes.

In asserting the predetermined products of phantasy, the hypothesis of archetypes appears as a pure mental abstraction or a speculation which is based neither on experimental data nor on clinical analysis, Jung's idealistic conception is extreme to the extent that it denies any possibility of creating anything new in principle, and links with extreme mechanistic conceptions of phantasy which regard products of creativity merely as imitation, re-arrangement or recombination of perceptive ideas.

The idea expressed by sculptor Henry Moore deserves special attention, for the advocates of the doctrine of archetypes widely used his sculptures as illustrations of their tenets: "But though the nonlogical, instinctive, subconscious part of the mind must play its part in his (the sculptor's) work, he also has a conscious mind which is not inactive. The artist works with a concentration of his whole personality, and the conscious part of it resolves conflicts, organizes memories, and prevents him from trying to walk in two directions at the same time" (217, 68).

Thus, Jung's theory almost emasculates the whole concrete psychological content of the subconscious, transforming it into a formal scheme predetermineding the nature of imagery. This conception is absolutely mystical in nature, its idealistic essence coming close to the conceptions which view phantasy as an original and inexplicable force. Yet, in contrast to the latter which nonetheless endowed phantasy with an ability to create new values, Jung's theory attributed to it merely a reproductive role.

NON-PSYCHOLOGICAL CONCEPTIONS OF PHANTASY

In the recent years, a number of authors have tried to explain the phenomenon of creating the new through conceptions borrowed not only from the sciences that border on psychology

(such as, physiology), but also from the sciences that are quite remote from it, such as mathematics, physics and cybernetics. Among such authors, we may, first of all, come across the names of the psychologists who have resorted to various sciences with the hope that the terms, conceptions and laws of these sciences may eventually prove more effective for explaining various psychological facts than specific psychological theories. At the same time, some physiologists, mathematicians, and especially cyberneticians who have achieved great results in their fields are trying to achieve similar results in psychology.

The materials of the 4th All-Union Congress of the Psychological Society (Tbilisi, 1971) include several papers devoted to the study of some physiological mechanisms of thinking and creativity (it is interesting to note that the terms "phantasy" and "imagination" is extremely rare in these papers). Some of these papers contain general references to the role of dynamic stereotype [G. A. Vyazovsky (97)] and of the electrical activity of the brain [A. N. Sokolov (89)], while others compare well-known psychological phenomena with certain physiological data [V. P. Zinchenko, V. F. Venda, and V. M. Gordon (105); L. M. Vekker (96)].

An attempt to tie creativity in with functional bilateral asymmetry has been made in an interesting physiological investigation by L. P. Pavlova and K. S. Tochilov (46, 242).

The significance for the physiology of the central nervous system of these and other similar investigations is unquestionable, yet they hardly shed any light on the problems posed by the psychology of phantasy since they fail to explain even the most ordinary phenomena, such as, for instance, the role of the incubation stage, let alone the key problem—that of the creation of the new.

In a number of works which have appeared of late, authors have tried to equate the activity of the brain with the operation of electronic computers, although in reality the dependence is reversed: it is the computers that are a highly remote and still extremely one-sided imitation of the human brain.

This method of penetration into the mysteries of the human brain simplifies its study to the extreme: to discover a new mechanism or a new law of the central nervous system, it would be sufficient to identify any psychic function or even activity with the brain mechanism.

We do not find a single fundamentally new psychological fact in any physiological study of mental activity; on the contrary, all these studies fully rely on the earlier established psychological data.

We would also like to note that at present the traditional physiological approach to the problems of creativity is gradually ousted by the mathematico-informational approach.

No doubt, the notions of the theory of information allow more accurate, more concise and more concrete definitions of psychological problems, and facilitate the revelation of logical inconsistencies in various postulates. By using the terms of the theory of information, it is easier to make a distinction among the phenomena which could present difficulties if we tried to differentiate them with the help of the traditional terminology; the criteria of the theory of information, on the other hand, facilitate enormously the objective evaluation of novelty as contained in one or another statement.

At first, some investigators believed that the theory of information would radically solve the problems facing the psychology of creativity. Their conviction was strengthened by the successes made in cybernetic programming which could effectuate complicated deductive operations. In fact, it is the feasibility of using one or another psychological conception of phantasy as the basis for producing artificial models imitating man's mental activity that enables us to determine the extent to which this conception "works", to which it answers the purpose.

The analysis of concrete psychological works on the study of mental activity, which treat the results of investigations in terms of the theory of information, proves that in a number of cases these results reveal no novelty, and some of them could be formulated a priori. Thus D. Berlyne makes wide use of the conceptual apparatus of the theory of information in his book *Structure and Direction of Thinking*, although it does not contain any essentially new conception of creativity (122, 40-42). Florence Vidal was equally unsuccessful in trying to identify the notion of information with the notion of structure (268, 176).

We have already noted that the theory of information is especially important for modeling psychic processes. This problem was discussed in detail by American psychologist Walter R. Reitman in his *Cognition and Thought*. Reitman does not underestimate the difficulties involved in modeling when he writes: "There may be differences between men and machines so fundamental that such models will be unable to go beyond what already has been achieved" (234, 47). Nonetheless, Reitman had to concede that "the drawbacks, though serious, may be temporary: the advantages and contributions are permanent" (234, 48). At the same time, he had to admit that his model, "Argus", is capable of solving certain problems of analogy

only because "human intelligence is applied beforehand to precode the information into a particular special purpose form" (234, 229). This means that successful modeling involves the penetration into the actual processes occurring in man's psychology and their translation into a special language (information coding). Only complete comprehension of the actual psychological laws of phantasy may help us build models capable of performing more complicated intellectual functions.

In one of our earlier works we pointed out that "the creation of a mathematical model of one or another hypothesis enables us to impart to it a strict quantitative expression, and thus to determine with the utmost accuracy the adequacy with which the hypothesis reflects reality" (69, 146). We side with the idea that "even a failure in modeling various psychic processes may shed light on our knowledge of the object of modeling", which implies that "modeling itself may serve as a method for verifying the consistency of certain psychological conceptions, hypotheses and theories" (34, 182).

By attributing such great importance to modeling we, however, should not overestimate its role in creating original conceptions. Modeling is most convenient for materializing and verifying the results of an investigation, although productive modeling of the objects of living nature, for example, should rest on the results of their study by the specific means of a particular natural science (physiology, psychology, etc.).

Outstanding Soviet physiologist N. A. Bernstein once noticed a serious methodological danger in modeling: the possibility that the essential intermediate links between the information "input" and "output" might be missed. A model normally provides information only on concrete and particular aspects of reality. Psychologists and physiologists used to compare the brain with a telephone switchboard, a power plant, a library, a theatre, a museum, archives, a court of justice, a parliament, etc. Each of these comparisons reveals this or that facet of the brain activity, ignoring other aspects. All this makes the model a valuable, yet limited, means of cognition. Robert B. MacLeod had this to say on this matter: "We may become so enamored of our models that we may either (1) exclude from consideration any phenomena which cannot be encompassed by the model, or (2) allow our research to degenerate into a mere linguistic exercise in which it is tediously demonstrated that the phenomenon can be 'taken care of' by the jargon of the model" (210, 208-209).

In discussing the utilization of notions of the theory of information for revealing the laws of intellectual activity,

Soviet psychologist M. S. Rogovin emphasized that excessive enthusiasm for cybernetic models eventually leads to non-critical borrowings of overly-formalized schemes incomparable with real facts. "The application of cybernetic schemes entails the same errors as had been typical of physiological schemes up to the recent days. We realize that such errors result from misunderstanding of its (psychology's) peculiarities" (53, 6).

Theoretical and practical efforts aimed at modeling intellectual processes have advanced to the foreground two interconnected problems: the problem of variants and the problem of algorithms. Both problems, in one way or another, have been raised and resolved by previous investigators of creativity. For example, V. Ya. Propp, an investigator of Russian folklore, came to the conclusion that thirty-one active functional elements are sufficient for producing models of the plots of a hundred Russian tales recorded by A. N. Afanasyev (50).

In his book *Two Hundred Thousand Dramatic Situations* Etienne Souriau furnishes the views expressed by different authors on the quantity of the variants of plots in drama: Italian playwright Carlo Gozzi, the father of a *feerie* comedy assumed that the number of dramatic situations totals but thirty-six. This opinion was shared by Johann Wolfgang von Goethe. Souriau himself, however, raises the probable number of such situations to 210, 141. Souriau believes that such a great number of variants is backed by the combination of six or seven simple, yet powerful and essential initial factors (the guiding thematic power, opposition to this power, the representative of the desired good, the obtainer of the good, the mediator who distributes the good, and finally, the rescuing power) and five principles for combining these factors (250, 11-14, 117).

In relying on such an interpretation of literary creativity one may presume that to become an author of plays and novels, it would be sufficient to master certain formulas and algorithms combining elements into different variants. There is a highly witty saying on this account made by Edwin E. Slosson and June E. Downey: "The reason why there is now an overproduction of the sort of fiction that once was a rarity is that writers have found out the formula. The reason why readers turn with sudden distaste from a form of fiction with which they have been overfed is because they too have found out the formula" (249, 97).

Thus, although algorithmization plays a positive role in the creation of devices capable of performing certain complicated intellectual operations, it has an effect diametrically opposite

to the expected one in the sphere of genuine creativity. Remarkably, the designers of more flexible algorithms undergoing improvements during research (the so-called heuristics, in the narrow sense of the word) had to admit some negative results of their application.

Allen Newell, J. C. Shaw and Herbert A. Simon offer the following example: let us try to imagine a chess heuristic which would immediately exempt from consideration any move exposing the queen to attack; such a heuristic would be an excellent rule of thumb for a novice player, but would occasionally lead him to miss a winning queen sacrifice. This leads the authors to the conclusion that reliance on ready formulas (heuristics) may simply result in the elimination of certain ways and sometimes all the ways for solving a problem (221, 82).

We would also have to note that by using selection (scanning) or heuristic choice, we may find only the elements which are already virtually available in a device or in the central nervous system. However, these methods are completely inapplicable to the detection of something new in principle which has not been present in the given "area of search". This means that in addition to selection and choice genuine creativity requires a transition from one investigated "area" to another, a radical change of standpoint, etc. Although these conceptions do not resolve the problems under investigation, they approach them most directly, which signifies their positive value.

The idea of feedback considerably broadens the horizons of psychology. Owing to feedback, an organism, and the devices modeling (imitating) intellectual activity, can reset their actions, for example, alter the direction of search, in case of an error. It is clear that the feedback principle is also essential for creativity which comprises a certain number of cycles, with each succeeding cycle presupposing the evaluation of the success of the preceding one.

At the same time, the utilization in psychology of feedback poses new problems, one of which may be reduced to the following: what is the frequency of the feedback? should it be continuous? It seems that unintermittent correction of any activity and constant resettings may eventually disrupt the stability of the functioning system. This explains why we have to raise the problem of the system's stability, and therefore that of limiting the feedback mechanism. The importance of this problem was substantiated by the father of cybernetics, Norbert Wiener, who emphasized that feedback should be limited in control systems if we want to achieve stability. Other-

wise, excessive feedback in a device may effect self-oscillations which will gain momentum so as either to destroy the device or, at least, make it practically uncontrollable.

The modeling of creativity, therefore, contributes to the elucidation of its specific human characteristics. By creating mechanical models and, moreover, in confronting the impasse in modeling certain peculiarities of phantasy we meet with highly accentuated distinctions between man and a cybernetic device.

The founders of the program "Logic Theorist", A. Newell, J. C. Shaw and H. A. Simon pointed out that their device "does not pose its own problems—it must be given these" (221, 69). L. Welch discerns the main distinction between the computer and man in man's exclusive ability to evaluate the results he has obtained and their consequences (273, 146). Berlyne who has made a detailed description of computer programming emphasizes the need of measures providing for a rigid procedure sequence ("a block diagram" in carrying out a task) (122, 189). In other words, in comparison with the computer, man has more freedom in handling both the information and algorithms at his disposal. Psychologist Harold Rugg asserts that a computer, first, "can answer a question but cannot ask it" and secondly "can 'think' logically, but not creatively" (241, XII). Rudolf Arnheim maintains that a computer is able to describe a figure made up of a combination of a square and a triangle, either as two individual figures or as a set of ten straight lines. "However, the machine has no preference for any one of these versions of the material, unless such preference is imposed upon it by the operator" (111, 73-74).

The distinctions between man's intellectual activities and operations carried out by an imitating device prove that the essential features of phantasy should include *activity*, expressed in setting forth one's own problems; *evaluation ratio*, expressed in the preference of certain ways of action; and *non-predetermination*, expressed in the possibility for deviation from the assigned sequence, for change in the shape and character of the information obtained, and for change in the evaluation and the task itself. Consequently, the adequate theory of phantasy should organically include all the above principles.

SUMMARY

The material presented in this chapter proves that representatives of almost all more or less significant psychological

trends, have made an attempt to solve the basic problem of phantasy: they have tried to find the causes for the creation of the new.*

The development of theoretical conceptions went on simultaneously with accumulation of facts, although it would be wrong to assert absolute parallelism of these processes: on the one hand, certain conceptions were based on intuition, on the other, a number of experimental results were ignored in various theoretical deductions.

The elaboration of a scientific approach to the problems of phantasy involves, first and foremost, the overcoming of two opposite views on the essence of phantasy: the extreme idealistic view which sees phantasy as the original spontaneous creative power, and the extreme mechanistic view which regards the emergence of the new as the result of a pure accident or recombination.

Comparison of facts with their theoretical interpretations enables us to assert that not a single hypothesis advanced so far has been able to embrace the whole scope of the problems of phantasy. Consequently, individual psychologists exerted efforts to eclectically combine different conceptions; thus, the Gestalt psychologists' idea of insight was supplemented by the behaviorist idea of manipulation, while Gestalt psychologist Arnheim sometimes resorted to the conception of analogy. We have also witnessed attempts to combine Gestaltpsychologie with Freud's psychoanalysis and Jung's doctrine of archetypes (Ehrenzweig). However, the purely external unification of diverse conceptions does not and may not eliminate the theoretical difficulties observed so far.

The process of studying the phantasy exposed a tendency to single out its inherent psychological problems and to make a distinction between the content of psychological descriptive and explanatory notions, on the one hand, and the logical notions bordering on them, on the other. Essentially, typical in this respect is the evolution of the notion of "abstracting", which may not be regarded today as the result of a strictly logical generalization of homogeneous phenomena.

In the course of studying creativity the logicized and externally organized schemes of creativity were supplemented with a scheme which relied mainly on incubation as a psychological fact. Quite reasonably, psychologists tried to tie it in with

* The only exception to this rule is perhaps Jean Piaget who, as was quite correctly noted by Berlyne (122, 5), showed little interest in creativity.

one or another theory fully realizing that this would augment its heuristic significance.

Highly illustrative in this respect is the way the idea of evaluation has penetrated into theories of phantasy. Although various stage-based schemes of creativity invariably include the stage of evaluation somewhere at the end of a creative process, the hypotheses which explain phantasy by analogy ascribe the evaluation to earlier stages; we have seen that application of analogy implies a change of the evaluation of the major or minor portion of the information used. The significance of the evaluation approach to mental activity also manifested itself in the comparison of problem-solving by man and a modeling device.

The selection of specific psychological aspects of phantasy thus enables us to be more accurate in formulating demands for its theory.

One of the peculiarities of early theories of phantasy was a desire to infer all the features of its products from images of perceptions as well as from the data stored in the memory. In other words, phantasy was turned into a reproductive process. Psychologists were utilizing the ideas of recombination, trial and error and even the phenomenon of synesthesia, yet the most "refined" conception in this respect was the hypothesis of analogy, according to which the products of phantasy correspond with the external reality indirectly rather than directly.

Of special value in these hypotheses is the recognition of organic bonds of any products of phantasy with actual reality; at the same time, the limited nature of these hypotheses and their inability to explain the majority of facts has evoked theoretical views which attribute the leading role to intrinsic psychological laws.

Interest in the intrinsic motive forces could be noticed already in the investigations conducted by the adherents of the Würzburg school which brought them close of the problems of motives and of the subconscious. The broadening of the framework of the psychic by incorporating into it the subconscious sphere has made it possible to reveal a new essential source of phantasy.

The introduction of the problems of phantasy into broader psychological context has created conditions for overcoming the opposition of phantasy to logical thinking deriving from rationalism, and has pointed investigators towards the establishment of general laws of mental activity. In this respect, a serious attempt was made by Gestaltpsychologie which advanced

the idea of an integral self-regulatory system, although in proving the principle of self-regulation, Gestaltpsychologists had to neglect a number of experimental facts that ran counter to this theory (in the same way, analogy could be adopted as an explanatory principle only if we ignored the scientific discoveries whose sense and content disagree with the images and ideas prompted by analogy). Therefore, an adequate theory of phantasy must take into account not only the phenomena of direct and indirect imitation of internal and external patterns, not only the systematization, improvement or consummation of extraneous data, but also phenomena which are opposite in character: deviations of the products of phantasy from external and internal patterns, violations in the direct process of improvement of the products of phantasy, etc. This boils down to the fact that the very theory has to contain the idea of possible erratic solutions and of the variants which cannot be reduced to the accumulated knowledge, the developed skill and the mastered algorithms.

Thus the creation of the adequate theory of phantasy depends on the selection of the basic facts and on the rational organization of experimental researches, i. e., on the solution of a number of methodological problems.

Chapter III

THE METHODOLOGICAL PROBLEMS OF STUDYING PHANTASY

The study of phantasy, as we have already shown, poses numerous methodological problems, the solution of which depends largely on the theoretical position held by the researcher. At the same time, a concrete methodological approach not only affects an author's theoretical views and his interpretation of experimental data, but also predetermines the choice of problems and aspects that he subjects to investigation.

Many Western psychologists are guided by the empirico-positivist methodology and, quite naturally, neglect the intrinsic laws of phantasy: they are fully satisfied with a purely external description of the statistical interdependence of what is fed to the input and what is obtained at the output. Such a position manifests itself most explicitly in the book *Studies in Genius* by W. G. Bowerman.

A consideration of the most essential methodological problems pertaining to the study of phantasy has to be initiated with an evaluation of the methods practiced in investigation of this process.

TRADITIONAL METHODS OF STUDYING PHANTASY

In compliance with the traditional view which differentiates thinking and phantasy as two different psychic processes (functions), the methods of studying these processes were completely different. A study of "pure" thinking mostly involved the use of all sorts of mathematical and chess problems which required the application of specific algorithms and the observance of the rules of logic, while in the study of "pure" phantasy the main emphasis was laid on images and their dynamics, on the emergence and transformation of images.

A multi-volume work on the scientific methodology of research

edited by Emil Abderhalden contains a special part written by J. Lindworsky devoted to the traditional methods of studying phantasy (204). Lindworsky has combined the methods of research into two main groups: (1) the methods of studying the prerequisites of the acts of phantasy; (2) the methods of studying phantasy proper.

Essentially, the methods of the first group include the tasks for the accomplishment of which a subject has to imagine a missing object or to trace the progress of images emerging after he has been exposed to a specific stimulus and to combine into a general image disjointed images (representations). These methods are adjoined by the researches carried out into color, spacial and other associations by Fr. Galton which are concomitant to certain representations and notions (156, 83-84).

The methods of research into phantasy proper include, first and foremost, the so-called *method of interpreting inkblots* consisting in finding the affinity between the actual perceptions of specific shapes of an inkblot and various household objects or natural phenomena (clothes, clouds, birds, etc.). Among these methods there is also the *method of supplement* introduced by Ebbinghaus, which requires that a subject fill in the blanks in a text. Some experimental tasks had missing words in sentences, others, missing sentences in a text.

The study of creative imagination (phantasy) should be made, according to J. Lindworsky, with the help of such methods as *making up a phrase* with the employment of several assigned words and *making up a story (plot)* on the basis of several reference words. For example, making up a story on the subject "What I Shall Do When I Grow Up" (this subject is offered to school children). This group of methods also includes the absolutely spontaneous composition of stories when neither key words nor subjects are provided as well as technological inventions and the solution of riddles.

Which ways were used by the researchers for processing the data obtained with the help of the above-mentioned methods of research? To begin with, they registered the time needed for accomplishing a task, then they took into account such factors as the role of external stimuli, the qualitative characteristics of conceptions engendered by an act of phantasy, etc. (204, 237-142). All of these methods served to determine the individual distinctions in the phantasy of subjects as regards the promptness of image production, the prevailing type of representations and the duration of the process.

Lindworsky noted that the results could be processed either

qualitatively (by content) or quantitatively (statistically), and "the individual objective elements are to be taken into account and considered depending on age, sex, environment, etc." (204, 151).

Among the traditional methods of studying phantasy, special place was devoted to the so-called *tests in originality* (L. M. Chassel): coinage of new words, composition of a text with the help of pictograms (pictures), invention of unusual analogies, solution of chainword puzzles, filling in of blanks in a text, coding of a text, invention of original methods of motion; making forecasts of consequences of various events, etc. However, Chassel fell short of proposing any criteria of originality.

Edwin Slosson and June Downey proposed two methods for testing the "fertility of imagination": first, determining how many plots a person can get out of one and the same message; second, determining how many personals a person can find plots for in a given time (249, 21).

These methods have never been used either to prove or disprove one or another conception of phantasy although, as we will show later, if an experiment is staged accordingly, the data obtained through these methods may shed light on certain theoretical problems.

On the other hand, the data obtained as the result of application of the same methods may be interpreted differently if they are regarded from the standpoint of different conceptions. This is easily discernible in the case of the Rorschach test and the methods of the Thematic Apperception Technique (TAT).

The test that bears the name of Hermann Rorschach, a famous Swiss psychiatrist, is a variety of the methods of interpreting inkblots which we have already described. The originality of *Rorschach test* consists in the fact that the experiment involves a whole series of symmetrical inkblots. A subject has to examine a succession of the blots of this series and to name the imaginary objects. For example, to different people, one and the same inkblot may prompt the image of a tree, a bear, a butterfly, a spouting fountain, a cloud, etc. The psychologists employing the Rorschach test have to record not only the answers given by subjects, but also their comments and emotional responses (surprise, content, boredom, etc.).

Denise Saada notes that there are "profound divergencies between the ways in which the results of Rorschach test are interpreted by different schools" (244, 205). Rorschach underlined, in particular, that in spite of the fact that "almost all

the subjects regard an experiment as a trial of phantasy" his test "has nothing to do directly with the function of phantasy" (238, 4). In his opinion, "the interpretation of accidental images rather falls under the concept of perception and comprehension" (238, 5); consequently, the results of this test "contain indications as to the content of psyche" and the character of subconscious "affective complexes" (238, 114). This explains why Rorschach places his methods on a par with the other psychoanalytical methods: interpretation of dreams, associative experiments, etc. This view is shared by S. J. Beck, the author of the two-volume monograph *Rorschach's Test*.

Representatives of Gestaltpsychologie used the results of Rorschach tests to prove the viability of a conception which identifies the perception of any real form with an integral process which may not be reduced to mere sensations. Yet, both psychoanalysts and Rorschach regard the results of his tests as the material which enables them to judge the content of a person's internal conflicts, the aspirations which have been ousted and complexes, etc.

Thus the methods employed for the investigation of phantasy which, at first, were aimed at solving purely applied problems (for example, the promptness of accomplishing a task) are gradually turning into a means for penetrating into deeper strata of psyche.

The Rorschach test closely borders on the so-called Thematic Apperception Technique (TAT) initially proposed by Henry Murray and then elaborated on in detail by a number of authors including Erich Stern and William Henry (254; 182).

The *TAT test* consists in the following procedures: a subject is given a series of pictures depicting typical situations after which he has to fulfil one or several of the following assignments: (1) to interpret the pictures; (2) to make up a story (plot) associated with the content of the pictures; (3) to compose a sentence (or its ending) on the basis of the depicted situation.

In his book *The Thematic Apperception Technique of Murray* Erich Stern writes that a person who relies on pictures in order to relate a series of stories is projecting in them his own feelings, desires, concerns and hopes. He believes that he is relating a story of the third party while, in fact, he is telling a story of himself. The test reveals subconscious trends, ousted desires and forgotten impressions (254, 147-148).

In his monograph *The Analysis of Fantasy* W. Henry is taking a broader view at the results of TAT tests. The principal

goal of the TAT technique, in his opinion, is the study of social and psychological aspects of personality (182, 59). The external, i.e., the content of the pictures, should serve as a motive and a stimulus for the utmost expression by a subject of the whole of his multi-faceted personality as well as for the projection of his subconscious aspirations. Even the negative content of the answers given by a subject (say, his silence over some details of the picture) is also highly informative, as it points to what the subject does not want to discuss (182, 51-56).

Thus, the TAT and Rorschach tests enable us to elucidate certain characteristics of personality: his aspirations and subconscious attitudes or sets, his inclinations and interests. At the same time we could see that the results obtained with the help of one and the same method can be interpreted differently, which means that the very choice of a method or of methods is not sufficient for ensuring adequate comprehension of the phenomena of phantasy.

MODERN METHODS OF STUDYING CREATIVITY

The juxtaposition of methods proposed by modern authors for studying creativity with the traditional methods of studying phantasy comes forth as an additional argument supporting the earlier expressed opinion which regards the modern problematics of creativity as actually a continuation and development of the classical problematics of phantasy. By and large, modern tests elaborated for the study of creativity essentially repeat the traditional methods of studying phantasy.

Frank Barron is referring to the following eight tests used for measuring originality (116, 141-142) which we would like to specify:

(1) *Unusual Uses*. A subject is asked to think of six ways of using various household objects. In processing the obtained facts, the investigators were taking into account the measure to which the invented uses are unusual, i.e., the extent to which one or another answer differed from those given by other subjects. An original variant of this method is the assignment to make an unconventional interpretation of insufficiently distinct drawings.

(2) *Consequences*. This test is also typical of the traditional methods (see above). A subject is requested to describe what might have happened as a result of various changes in a particular situation, the most improbable answer being considered

the best. George K. Bennett and Alexander G. Wesman point out that the experiment should involve the situations which exceed the limits of the life experience of the subjects. In processing the results, the researchers take into account the quantity and originality of answers rather than their scientific footing (121, 282).

(3) *Plot Titles.* Subjects are advised to invent as many as possible titles to two plots, the originality of the titles being evaluated on a five-point scale.

(4) *Rorschach.* This test has already been described. In processing its results the researchers take into account only original answers.

(5) *Thematic Apperception Test: Originality Rating. TAT Protocols.* This test has already been described (in this series of tests, however, the TAT and Rorschach tests serve the purpose of determining creative abilities rather than revealing psychoanalytical complexes).

(6) *Anagrams.* A subject has to coin words using the letters comprising an assigned word. The solutions furnished by the subjects are compared against each other, and those correct results that are rare (produced by at most one or two subjects) rate as original.

(7) *Word Rearrangement Test: Originality Rating.* A subject is making up a story which should include the maximum possible number of words of the fifty available nouns, adjectives and pronouns. The originality of the story is evaluated on a ten-point system.

(8) *Achromatic Inkblots.* The experimenter composes a set of ten achromatic inkblots, and each blot, in contrast to Rorschach test, has to be interpreted only once by a subject. The originality of answers is determined by discriminating unrepellent (unique) interpretations.

The tests proposed by Jerome L. Schulman that follow may be regarded as a variety of these methods: a test which requires that a subject supplement a drawing using assigned combinations of various lines as the basis; a test in performing which a subject has to discover closed spaces among the complexity of shapes offered to him.

Therefore, out of the eight tests specially selected by Barron for investigating creativity, at least five had been described earlier as methods for studying phantasy. The essential peculiarity of the contemporary methods, however, is the employment of almost unambiguous criteria of originality.

The methods collected by Barron are constantly supplemented

by new tests. Of special interest is the test in which a subject is offered a number of objects and instructed "do something with every item". The test has to reveal the intellectual initiative of a subject. In the opinion of Sidney J. Parnes, the results of the test make it possible to reveal the so-called sensitivity or perceptibility to problems (225, 166). In this respect much importance is attached to conversations on unusual subject matters in which the experimenter expresses unusual ideas. "If a student," L. Thurstone says, "responds immediately with a clear proof that the new idea is all wrong, then the negative suggestibility is not a good sign. I would rather gamble on a student who toys with a queer idea to see what the world would be like if it were really so" (263, 13). These tests are based on the theoretical assumption which allows an antagonism between the strictly logical thinking and the creative approach; the former, in the opinion of these authors, seems to subdue phantasy, hindering its free development in all directions.

A view of creativity as an act opposed to logical thinking has also been laid at the foundation of the tests in which subjects are provided with the information insufficient for a plausible solution of a problem. One of the variants of this test was described by Malcolm Westcott. Subjects of his test can obtain additional information indispensable for solving each problem "in small quantities" on separate sheets. Westcott believes that "the less information the subject takes before attempting a solution, the greater is the intuitive component in the act of solving the problem" (275, 41-42).

A serious step toward the creation of fundamentally new methods needed for the investigation of phantasy was, undoubtedly, the application of *unsolvable problems*. A. Luchins emphasizes that "creativity may consist of demonstrating that no solution is possible under given admissibility conditions" (207, 132). G. A. Shouksmith has elaborated concrete methods based on unsolvable problems. In his tests, a subject was provided with drawings featuring sticks, different in length and inclination, protruding from the ground. The subjects had to determine which of the sticks was planted deeper into the ground. Shouksmith was mostly interested in the extent to which subjects saw the significance of these pseudoproblems. Further on we will prove that the problems of this kind can provide us with important facts and conclusions.

In recent years, *semantic* (particularly, verbal) material has been gaining wider application. In one of their tests, V. Fisichelli

and L. Welch advised subjects to compose as many as possible phrases with obligatory use in each phrase of assigned words. In another experiment staged by these authors, subjects had to write compositions using mandatorily the words from an assigned list (273, 144). G. Broadbent believed that a person's creative faculties could be revealed by the methods aimed at elucidating the subject's ability to give the maximum number of definitions to words familiar to him (130, 114). J. Guilford offers the following verbal test: a subject is provided with the initial letters of four words which should combine into a complete sentence; for example, the letters W-f-s-n may produce the phrases: "We found some nuts", "Who fought Sam Newton?", "Willy Frank smiled notoriously", and so on (170, 423). A similar task may be further complicated by introducing into it additional conditions, such as limitation of the number of letters in each word. S. and M. Mednick proposed a remote-association test: finding a word the meaning of which may be associated with three assigned meanings; for example, the attribute "iron" may equally well be applied to the words "will", "railroad" and "mask" (215).

It would be especially advisable to employ verbal material for introducing the notion of open tasks (otherwise, "not clearly defined") as compared to closed tasks ("clearly defined"), the latter presupposing a strictly specific unambiguous solution while the former, a multitude of solutions [Van de Geer (157, 22), Hyman (187, 71), Kozielecki (197, 25)]. However, essentially, the new class of tasks on studying creative thinking has always been applied to the study of phantasy, the methods of research of which are suggestive of different solutions. This links the latest researches in the sphere of creative thinking with the traditional studies of phantasy.

There are methods which have been devised especially to support the traditional psychological theories. Thus, Welch and Fisichelli have conducted a number of experiments to confirm the associationist conception of phantasy according to which every novelty is the result of recombination. They compared performance of one and the same task by people with different experience in the particular field of knowledge. Using the results of the experiments which were higher in more experienced people, they drew the associationist conclusion about the role of training for successful combinatory acts measured by promptness and productivity (273, 144).

Rudolf Arnheim describes the methods for investigating creativity used by his followers Abigail Angell and Brina

Kaplan: subjects were asked to use abstract drawings for expressing the notions of "past", "present", "future", "democracy", "good and bad marriage", "youth", etc. In fulfilling their tasks the subjects were resorting to usual or conventional pictographic images. For example, a growing tree served to symbolize the notion of "youth", while a "plus" and a "minus" were used to describe good and bad marriages. According to Arnheim, the fact that even abstract notions may find their expression in visual images supports his conception of "visual thinking" (111, 120).

The analysis of the traditional and modern methods applied to phantasy (creativity) studies enables us to make a number of methodological conclusions. To begin with, we have ascertained that there is a great variety of tests and methods and their number can be augmented by varying the experimental material, conditions of experiments and criteria of evaluation of originality. At the same time, a mere qualitative accumulation of methods would not have promoted any further the theory of creativity: the interpretation of the facts obtained by the modern methods is limited to the framework of traditional psychological associationist and Gestaltpsychological conceptions.

Although some of the methods we have analyzed served to confirm one or another theoretical conception of phantasy, the majority of these methods could only serve as tests for revealing specific individual faculties of personality.

In fact, almost the whole stock of psychometric means is employed mainly for measuring the specific qualities characterizing a person's creative abilities: originality, flexibility, productivity, perceptibility, etc. Luchins was absolutely right in his assertion that "contemporary research on creativity is concerned mainly with studying creative individuals" although it is more important "to study creative acts rather than actors" (207, 128).

Many contemporary tests and methods used for studying creativity do not in fact differ in character from the classical methods for studying phantasy and from the latest methods for studying thinking, especially from open tasks. By and large, the methods we have discussed, based on the use of semantic material, are identical in principle with those of "filling the gap", of "substituting figures with letters", etc. proposed for the study of thinking by N. Maier, Szeke and Fr. Bartlett (119, 24-35, 51, et seq.).

In evaluating the existing methods used for studying phantasy, we deem it important to underline that the decisive factors

for revealing its general laws are the proper methodological orientation of our experiments, the proper choice of objects of research and, finally, the proper correlating of essential and random facts, rather than experimental procedures *per se*.

UNIVERSAL CHARACTER OF THE LAWS OF PHANTASY

The problem of the object of research, whose study provides us with the most adequate theoretical conclusions, is organically linked with the methodological problem of the universal character of the laws of phantasy. To be sure, without general laws that are equally applicable to all the manifestations of creativity, we may not use indiscriminately any material as a reliable basis for our theoretical deductions. Conversely, by recognizing such general laws we would have to accept the logical outcome they entail which equates all the objects of investigation needed for making theoretical conclusions.

Until only recently psychologists were concerned mainly with the study of concrete types of creativity, i.e., the creativity of scientists, musicians, artists, inventors, etc. Those investigations were usually focused on the problems of concrete skill, knowledge, and knowhow, yet they almost utterly neglected the psychological essence of creativity.

Of special interest in this respect is Henry Poincaré's attitude toward the problems of psychological research into creativity and phantasy. In his report made to the Psychological Society in Paris he said, in particular, "I can tell you that I have found the proof of a certain theorem under certain circumstances. This theorem has an odd name which many of you will not understand; but this is not what matters: the psychologist has to be interested in the circumstances rather than in the content of the theorem." (174, 8). Obviously, the circumstances should not be regarded merely as external conditions, but rather as the internal psychological laws. The emphasis placed on the role of psychological factors in creativity brings us close to the problem of the universality of the laws of creativity.

There are a number of modern investigators of creativity who hold that all its laws are universal and general regardless of the object of creativity. Jacques Hadamard pointed out that "mathematical invention is but a case of invention in general, a process which can take place in several domains, whether it be in science, literature, in art or also technology" (173, XI). Edgar W. Vinacke shared this opinion by saying that

he saw no reason to believe that the artist's thinking was different in principle from the scientist's and that there could be found any difference in their ways of thinking from that of an ordinary person (269, 238-261).

The idea which universalizes all the psychological laws governing the creative processes in all the spheres of human activities can be regarded almost as universally accepted, gaining an even more categorical backing in various recent studies [Rogers (237, 71), Gordon (165, 5), Bronowski (132, 14), Vidal (268, 3), Kauffmann, Fustier and Drevet (195, 19), Rouquette (239, 73), etc.].

Michael Middleton has made an attempt to explain why separate forms of creativity are presented as genuinely creative even though creativity is almost ubiquitous by nature. He says that although many kinds of human activities are characterized by creativity, this trend manifests itself most explicitly in fine arts owing to their autonomous nature. They embody creativity in its most pure form. Yet, in applied arts, in science and in human deeds this picture is blurred by many other factors, which does not minimize the creative element in them (216, 71).

In contrast to the traditional views on creativity as an activity accessible only to the selected few, some modern psychologists hold that "we ... cannot grant a monopoly of creativity to the exceptional genius while the rest of the population is occupied with routine duties" (110, 375). It is emphasized that "the elucidation of interindividual differences in creativity can hardly advance very far until we understand the mechanisms of directed thinking in general" (122, 320). J. P. Guilford has expressed in a number of his works the idea that in studying creativity we may not confine ourselves to a limited number of the selected few. He believes that "creative potential is distributed continuously throughout the human race. The geniuses are merely at the upper tail of the distribution" (170, 421-422).

Thus, as we have seen, earlier researchers saw creativity as an extraordinary and exclusive phenomenon; in present-day work, on the other hand, we can discern a pronounced tendency to consider the creative process from the angle of the general laws which are universal for all people. The new orientation is mainly based on the fact that today the stress is made not on the results of creativity which may not be equalized under any circumstances, but on the *internal psychological mechanisms* of universal character. This explains why the revelation of qualitative characteristics of such mechanisms does not involve a selection of especially gifted people, although

the reasons indicative of the distinctions among persons whose creativity is realized in the products of different social value, undoubtedly evoke major scientific and practical interest.

Thus, the opinion supporting the universal character of the intrinsic laws of mental activity is gaining the popularity among the researchers. Consequently, as long as the general laws governing phantasy are inherent in the psyche of *any* person involved in *any* productive activity *regardless* of its character and content, there is, naturally, no need to give preference to any special activity or to any special category of subjects while planning an experiment. In other words, there is no limitation in principle in the use of psychological material for establishing the general laws of phantasy, even though, presumably, such laws will manifest themselves more or less explicitly in various experimental situations. It is only in this sense that we can refer to the experimental material to be preferred.

THE IMPORTANCE OF NEGATIVE FACTS FOR REALIZING THE INTRINSIC LAWS OF PHANTASY

We believe that exclusive attention toward positive facts and almost thorough negligence of negative facts are the most essential methodological drawbacks of the traditional experiments staged to study both mnemonic and intellectual phenomena. This is largely explained by the following circumstance.

No matter what activity a subject is involved in he is guided by specific goals which must be achieved as a result of his activities. He can be trying, for example, to reproduce the necessary information or solve a problem. Indeed, any purposeful activity is reasonable only when it leads to the desired result. This determined the traditional methodological approach to the study of mnemonic and intellectual processes, the accent in which was placed on positive facts. As an example, let us first consider the study of memory.

The classical experiments aimed at studying man's ability to memorize and to store information, beginning from Ebbinghaus's experiments, revealed the following essential aspects: first, the methods *ensuring* flawless reproduction; second, the circumstances *hindering* flawless reproduction (for example, the duration of the time interval, interpolated material). This methodological approach which served as the groundwork for an experimenter's study of the conditions either ensuring or, on the

contrary, hindering the procurement of the desired result stipulated the theoretical interpretation of these experiments which was typical of the traditional psychology. In the traditional theories, numerous mnemonic phenomena were placed in dependence mainly on factors extraneous to the subject: the way of presentation of material, the quantity and alternations or repetitions of specific events at the moment of their learning (such as coincidence of events), etc. Meanwhile the *irregularities* characteristic of acts of recollection were either completely ignored or explained by various extraneous circumstances. In other words, they did not materialize as a logical outcome of the postulated mnemonic laws.

A considerable step forward in studying memory was recognition of the methodological demand to combine the positive and negative mnemonic phenomena into a single theoretical context. In other words, it was associated with the realization of the necessity to explain all the phenomena by the universal general laws. This methodological approach not only led to the discovery of new facts, but it also helped formulate the probability conception of recollection which has it that the information equally important for the subject is recollected with equal probability (55; 59; 66; 69).

We have discussed several methodological aspects of the study of memory since they have a general psychological significance and are of paramount importance for students of phantasy as well.

The idea of the probable affinity of diametrically opposed phenomena was expressed already in certain early works on phantasy. For example, it was noted that certain individual features, such as neologisms, caused works of talent to resemble maniacal delirium (112, 150-151). By pointing out that "imagination is present in all the acts, in all operations of the mind, both legitimate and less founded", L. Dugas is stressing the following idea: inventiveness "is more noticeable in errors than in verities" (143, 7).

This enables us to presume that the negative facts have a certain significance for comprehending the essence of phantasy. Characteristically, the followers of Würzburg school—the earliest investigators of mental activity—sought to formulate the general laws so as to use them for explaining all the observed facts.

However, a number of modern experimenters concerned with the study of intellectual activity are interested exclusively in positive facts; meanwhile, in the same way as in the study of

mnemonic phenomena, the erratic intellectual acts either stay beyond researchers' field of vision or are explained by extraneous reasons, i.e., are not tied into the general laws of mental activity itself.

As we know, the mechanist conceptions (behaviorism) preclude every possibility of the existence of any intrinsic psychological laws governing mental activity. This logically results in negating the heuristic value of its experimental study. Gilbert Ryle was most consistent in promoting this standpoint.

In comparing intellectual acts with a game, Ryle emphasizes that a good cricket or football player has to be a person who has mastered the rules of the game, the conformable technique, and the necessary skills. According to Ryle, the situation is no different with intellectual activity: to solve any problem successfully, a subject has to possess the conformable skills and the knowledge of specific logical and other algorithms. Thus, any mental activity is nothing other than a series of complicated skills and habits mastered in the process of practice and training. It would be completely illogical to try to find the intrinsic laws of mental activity here, since the considered methodological view excludes their very existence: all peculiarities of mental activity are fully exhausted and stipulated by numerous extraneous factors which were known before the experiment.

However, in contrast to Ryle, various psychologists come to realize the determining significance of internal factors in behavioral phenomena, including intellectual activity. "Since behavior," Berlyne points out, "depends jointly on the nature of external stimulation and on the condition of the organism and since ... behavior becomes more and more autonomous and less dependent on the external environment as we ascend the evolutionary scale, there is a need to consider the internal variables that play a part in the selection of the response and how their values are determined" (122, 238).

The recognition of internal reality by Berlyne, however, suggests the presumption of two equally valuable groups of determining factors—external and internal—which stand forth as circumstances of the same order, interacting, yet essentially self-sustained and independent. We have here a purely eclectical combination of external and internal factors.

S. L. Rubinstein expressed a profound dialectical view of the interdependence of external and internal factors in psychic phenomena, emphasizing that every external action is refracted through internal conditions (83, 315). Undoubtedly,

the recognition of the internal psychological reality is inseparable from the recognition of internal psychological laws governing this reality.

The question arises, however, whether it would be legitimate to attribute to these laws the Gestaltpsychological principles of "changing Gestalt toward perfection", "seeing the possibility for a transfer", etc., and whether the notions of "analysis", "synthesis", and "generalization" have to be regarded as the intrinsic laws of intellectual acts? If we give positive answers to these questions, we would have to side with Ryle in admitting that "thinking is an art, like cricket, and not just a natural process" (243, 194). In reality, these "general laws" may only be applied to explaining the facts of *successful* accomplishments of tasks, yet successful actions represent but a *particular* and exceptional case resembling art or mastership accessible to those who have mastered the required skills and techniques.

Meanwhile, if we assume that phantasy is governed by its intrinsic laws, the latter, as any other objective laws of nature, operate ineluctably and imperatively, being discernible in both successful and erratic solutions. Moreover, the intrinsic laws will obviously manifest themselves most conspicuously in erratic or illusory solutions, although they may also lead to correct solutions; however, in this case the intrinsic laws may be camouflaged by various logical techniques and mastered algorithms.

We have thus established a close interdependence of the three methodological problems determining the study of phantasy on: the problem of intrinsic laws, the problem of their universality, and the problem of negative facts. In more concrete terms, the recognition of the *immanent* character of the laws of phantasy, their independence from the peculiarities of assigned tasks and from the material and even the experience and training background of a subject, virtually implies the recognition of the *universality* of the laws of phantasy. At the same time, it would only be sensible to recognize the viability of the immanent laws if they are not formulated as a mere set of ethical rules for ensuring positive results, but as the natural laws applicable both to correct and erroneous acts equally well.

It would be thus important to note that a recognition of intrinsic psychological laws does not fully exclude a possibility of purposeful control of acts of phantasy. On the contrary, such a control must be based on reasonable application of psychological laws, i.e., on the adequate knowledge of internal

reality. Therefore, on the basis of this assumption, learning is apprehended as a conscious mastering of the mechanisms of phantasy rather than merely the superimposition from without of information, rules and algorithms of intellectual acts with the intent to successfully accomplish creative tasks. In other words, positive results of acts of phantasy may be achieved only provided we do not neglect its intrinsic laws since, otherwise, this is likely to lead to undesirable effects.

METHODOLOGICAL PROBLEMS INVOLVED IN EXPERIMENT PLANNING AND EXPLANATION OF RESULTS

The range of moot problems associated with the study of phantasy extends far beyond the problems of experimental methods, materials and objects of investigation. Above all, we have to point out that the experiments, the result of which can easily be predicted *a priori*, are notably inconsistent methodologically. In Chapter II, in connection with the discussion of analysis and synthesis, we asserted that whenever the material of a task is integral, its solution, naturally, presupposes but a single act—analysis; if the material has been divided by an experimenter, a subject is expected to synthesize its components. When Welch (273) advised his subjects to contrive specific household objects out of an assigned set of geometrical figures, and Newell, Shaw and Simon (221) instructed their subjects to find a way out of a maze, we can, in foreshadowing the results, predict that in the first experiment the subjects would be performing combinatory acts, while in the second, full or partial scanning of variants. Consequently, the results become known long before these experiments have been performed, which questions the very valubleness of such experiments.

Insufficient informativeness of the results of experiments aimed at studying intellectual activity, obviously caused a great number of psychologists to give preference to essentially different methods of obtaining information, such as observation and, especially, introspection (self-observation). Way back at the onset of the experimental study of thinking Ribot and Binet qualified introspection as the only way to adequate cognition of the inner world (126, 9). At present, Donald M. Johnson who has never underestimated the importance of authenticity, reliability and accuracy in the experimental results, points out that "the method may be too blunt to detect the subtleties of the

thought processes" (192, 42). However, even though Johnson admits the equality and usefulness of both experimental and introspective methods, believing that they supplement each other, a number of other psychologists, such as K. Heymann, attribute the main role to introspection (183).

The role and significance of introspection has still not been fully determined. In our opinion, the truth has been most closely approached by those psychologists who consider it useful to obtain information from all sources, including introspection. Yet, it would be necessary to emphasize that the data obtained through introspection has to be regarded as primary raw material which would have to undergo a serious transformation. In other words, the driving mechanisms of phantasy, its reasons and motivation have to be assessed by an experimenter rather than by his subject who only may serve as the source of initial information. This opinion is expressed by N. Kostyleff (196, 15-251), A. Burloud, Van de Geer (157, 12), etc. Consequently, the introspection data may be regarded as a means of description but not of explanation.

A question arises: what does an explanation of psychic phenomena have to imply? One of the most widely circulating answers to this question is contained in the conception of *reductionism* which reduces the notions of a particular science to those of other sciences. In summarizing the methodological orientations of a number of psychologists, John Gaito and Dwight Leonard maintained that certain psychologists revealed a pronounced trend to interpret an explanation as a reduction of psychic phenomena to underlying physiological and biochemical correlates (155, 69). This interpretation agrees with the methodological principle of *isomorphism* which endows all psychic phenomena with definite neurophysiological correlates. The hypothesis of *isomorphism* is a contemporary form of *psycho-physical parallelism*. Besides, as we have proved in considering the non-psychological conceptions of phantasy (see Chapter II), a simple substitution of the terms of one science by the terms of another adds but little to our general knowledge. A number of foreign authors, however, have realized the futility of reductionism* since it leads to disregard for the qualitative originality and specific features of each science [e.g., Gregory (167, 150-151), and others].

* Note, reductionism reveals a much more general tendency: to substitute one problem by others. In Chapter II, we discussed various attempts at reducing the problems of phantasy to the problems of perception, memory and emotions.

If we, in contrast to the adherents of reductionism, admit not only the reality of psychic processes, but also the reality of specific laws governing them, we may, quite reasonably, find it possible to explain psychic facts by the means of a particular psychological science. Naturally, this allows us to use the data provided by conformable sciences for interpreting the phenomena of other levels associated with phantasy (e. g., numerous essential peculiarities of the motor components of creativity must be explained by physiological laws).

At the same time, the ends and the character of a psychological explanation are interpreted differently by different authors. There are investigators who regard a psychological explanation as dovetailing observed facts with well-known and unquestionable truths. Charles Spearman writes on this account: "the creativity should be traced down not to processes or laws of any novel and wonderful kind, but on the contrary to those which are most familiar and most self-evident..."

"These ... laws should be ultimate, so as to have the widest possible extent; the laws should not be deducible from ... more general" (252, 14). It would be easy to notice that Spearman's criteria may turn out to be incompatible: quite probably, the most extensive and universal laws, which may provide an adequate explanation of all the facts, will eventually turn out to be most "novel and surprising".

D. E. Berlyne gives this interpretation to the scientific explanation in psychology: "To explain an event means to reconstruct a succession of transformations that connect it, link by link, with some state of affairs that we take as our starting point" (122, 82). Such an interpretation, in turn, reveals at least two issues: first, how far do we have to advance in search of "the starting point"; second, what has to be adopted as "the starting point"?

In connection with this, we find it necessary to dwell on the distinctive features of *descriptive* and *explanatory* concepts in psychology.* In a number of publications we pointed out that a strict differentiation of descriptive and explanatory notions is an indication of the theoretical maturity of a science. On the

* In touching upon the division of scientific terminology into "the observation language" and "the theoretical language" adopted in a number of scientific disciplines, Rudolf Carnap characterizes the latter in purely negative terms: the theoretical language "contains terms which may refer to unobservable events, unobservable aspects or features of events" (136, 38). We give preference to the terms "descriptive" and "explanatory" notions because they, in our opinion, reflect more exactly the role of these notions in the process of cognition.

other hand, by neglecting the production of explanatory notions, confusing them with descriptive notions and, still worse, substituting the former by the latter we will lapse into empiricism and positivism (81, 79).

The other reason for attributing such a great significance to the differentiation of descriptive and explanatory notions lies in the fact that this enables us to define more precisely the subject of our argument in discussing various experiments and theories and to establish the aspects which need additional elaborations: basic facts or a theoretical construction. This differentiation will also engender certain criteria for evaluating descriptive and explanatory notions. Thus, it would be advisable to assess positively a profusion of descriptive notions, reflecting the diversified character of natural phenomena. Moreover, the number of new descriptive notions introduced by a researcher attests to the volume of information he has obtained from reality as a result of his experiments and observations.

Explanatory notions have to meet completely different demands. They should naturally materialize from the fundamentals of a particular science and organically combine disintegrated and even remote phenomena, exposing their unity against the background of their diversity. In their having a great number of common features, explanatory notions may not be numerous: on the contrary, the fewer of them are used for interpreting facts the more exact and perfect a theory seems to us (77, 140).

The elaboration of explanatory notions for the phenomena of phantasy calls, first and foremost, for a profound study of the respective experimental data which, however, (as we have already noted), must contain new information on psychic reality, i.e., not predictable a priori.

SUMMARY

The diversity of facts in which phantasy manifests itself has engendered a great number of methods for its investigation, and their number can be easily augmented by introducing modifications, no matter how insignificant, into the practical methods. As a rule, the main intent of these methods was to classify persons on the basis of certain criteria, rather than to reveal the intrinsic laws of the process of phantasy.

The coincidence of the traditional methods adopted for investigating phantasy with modern methods used for studying creativity serves as one more proof of close affinity of the scientific problems studied on their basis, while their affinity

in principle with the modern methodology used for studying "creative thinking" (the so-called class of open problems) indicates that in both cases we deal with essentially the same psychological reality.

The consideration of certain methodological problems of investigating phantasy which we placed among the key issues has led us to the conclusion that a successful revelation of the internal laws of phantasy may involve a wide range of subjects and the employment of most diverse experimental procedures using any material or activities. The recognition of the existence of the internal laws which is organically connected with the recognition of their universality, naturally, causes us to realize the necessity of considering both positive and negative facts. The most informative results are provided with an experimental scheme which creates conditions for a fuller and more exact manifestation of the internal laws; such a scheme must either ultimately exclude or minimize the screening influence of skills, adopted algorithms, external factors for the accomplishment of a task, the character of instructions, etc. This explains why negative phenomena may provide us with more relevant information than their positive counterparts, and open problems have a number of advantages over closed ones.

At the same time, the revelation of internal laws of phantasy, as of any other general laws, no matter in what sphere of phenomena they may be inherent, presupposes a differentiation of descriptive and explanatory notions because only the latter serve to reflect the most general and typical features of the phenomena under study and their specific psychological essence.

Chapter IV

EXPERIMENTS (METHODOLOGY, RESULTS AND DISCUSSION)

In Chapter III we have formulated a number of requirements for the rational staging of experiments aimed at studying phantasy. Above all, it is necessary to secure a variety of correct solutions characteristic of open-type problems. These include simple and generally accessible problems based on the employment of semantic (verbal) material since they do not require of subjects any special experience or skills other than the knowledge of elementary grammar rules and ways of combining words in their native language. In this sense, the semantic material presents major advantages.

The other condition for a successful investigation of mental activity is, as we have already noted, a study of negative phenomena which reveal most explicitly the internal laws of phantasy. Quite naturally, we may discover negative facts in every research, yet their quantity is increasing considerably when subjects have to accomplish either unsolvable or extremely difficult tasks.

THE FIRST EXPERIMENTAL SERIES

The main idea of this experimental series lies in the fact that along with simple semantic (lexical and grammatical) problems, subjects receive either unsolvable or difficult problems. In compliance with the methodological approach we have already discussed the experimenters are most interested in the acts performed by subjects which are based on the internal psychic reality rather than on instructions or extraneous algorithms.

We selected subjects for our experiments among 11th-form students in seven full-time secondary schools of Minsk (the experiments were conducted in 1964/65 academic year).

By choosing the 11th-form students (18-19-year-olds) as subjects

for our experiments we were guided by the following reasoning: since our objective was to reveal the intrinsic laws, we had to exclude from our experiments every condition that could make us to interpret negative facts as resulting from the subject's age, "insufficient level of intellectual development", "immaturity of thought (thinking)", etc., which could be justly attributed to the junior. In our experiments we employed a modified methodology of combining words according to a pattern with an assigned pair of words, featuring a specific relationship: an object and its color (snow—white); an object and its creator (a book—a writer); a kind and species (footwear—shoes); antonymy (cold—heat), etc. Our subjects were given sheets of paper with columns of conformable words. Each column (heading) began with a pair of words which defined the sense relationship which, the instructions demanded, had to be the same for each pair of words in this column. Thus, if a column began with the pair "cold—warm", it meant that all the other words under this heading were to be provided with their antonyms: "merry" to the word "sad"; "weak" to the word "strong", etc.

Almost every other column contained words which presented no difficulties for a subject in finding the right word, as well as the words which made it extremely difficult and often impossible for a subject to find suitable words. Therefore, a number of columns contained both solvable and unsolvable problems. To illustrate this, a column which required that a subject specify the color of an object implied, for example, that a solution was possible for the word "coal" and impossible for the words "wind", "hope". In the same way, the column of verbs which required that a subject provide them with direct objects included intransitive verbs which could not be used without prepositions for expressing the Accusative Case in the Russian language [Cf., "to work", "to (have a) rest"]. The character of the relationships thus manifesting themselves between notional words in each column and the contents of the latter are available in Tables 1 through 10.

This series of experiments involved a total of 177 subjects. The experiments were conducted in classrooms during one of the lessons. Students received two variants of tasks, thus those who shared a desk had to perform different tasks. The protocols were anonymous.

Subjects were instructed orally by the experimenter—the author of these lines. The instruction read: "The task we are giving you is not aimed at testing your mental abilities, therefore, do not

sign the sheets you have received. We are interested in the extent to which you comprehend the assignment and in how you trace the semantic and logical relationships between words. You see that your sheets contain columns of words, each column being headed by a pair of words followed by five single words. The first pair of words determines the relationship which has to be observed in this column. Consequently, you have to select the right words to the assigned ones according to the pattern, i. e., the first pair. For example, if the first pair contains the words "strong-weak", then the word "quick" would require the word "slow". We would like you to approach this task seriously and fulfil it conscientiously. If you find a word or a whole column difficult for you, skip it."

The students of three forms (87 persons) were warned that they would come across a number of cases where it would be impossible for them "to give an answer", whereas the other four forms (90 persons) were not given such a warning. In warning the subjects that it would be impossible for them to fulfil their tasks completely the experimenter said: "There are instances when it is impossible to provide an assigned word with its conformable counterpart because this would run counter to grammar rules or just logic and common sense. In such situations do not write anything to the assigned word."

Additional explanations, if necessary, were provided before subjects started to fulfil their tasks. Subjects were also instructed not to ask any questions while accomplishing their tasks. The tasks were fulfilled within 45-50 minutes.

Fulfilment of a task was considered correct when alongside answers columns had omissions in the cases where problems were unsolvable. However, the experiment showed that subjects often wrote words in the places where omissions were expected. We regard such solutions as *illusory*, because they cannot be qualified as erratic; a real error also has involve the possibility of a correct answer, whereas in a number of cases the task did not imply such a possibility.

Tables 1 through 10 contain the quantitative results of this experimental series. In the left-hand side of the Tables you can find the data of the experiments conducted with subjects who had not been warned about unsolvable problems; in the right-hand side, the data obtained in the experiments with subjects who had been so warned. The number of the obtained answers is expressed through the percentage of the total number of subjects specified in each part of the Table.

The Tables prove that "easy" words were provided with

Table 1

The Assigned Relationship: An Object and Its Creator
 (The Pattern: "A Book—A Writer")

Assigned column of words	Subjects not warned (44 persons)			Subjects warned (48 persons)		
	Correct answer	Erratic or illusory solutions	No answer	Correct answer	Erratic or illusory solutions	No answer
theory	89	4	7	92	2	6
picture	100	—	—	98	2	—
chess	2	89	9	6	75	19
verses	98	2	—	100	—	—
skates	5	84	11	6	75	19

Table 2

The Assigned Relationship: An Object and Its Color
 (The Pattern: "Snow—White")

Assigned column of words	Subjects not warned (42 persons)			Subjects warned (46 persons)		
	Correct answer	Erratic or illusory solutions	No answer	Correct answer	Erratic or illusory solutions	No answer
coal	100	—	—	100	—	—
moss	90	5	5	96	4	—
air	33	58	9	31	49	20
hope	—*	55	45	—*	13	87
wind	—*	64	36	—*	20	80

* The asterisk indicates that no correct answer is possible.

correct answers by practically all the subjects; in a number of cases the percentage was as high as 100 per cent. Correct answers were provided to the words "picture", "verses" (Table 1); "coal", "moss" (Table 2); "school", "ball" (Table 3); "to draw" (Table 4); "light", "day" (Table 5); "sorrow" (Table 6); "well" (Table 7); "hen", "apple-tree" (Table 8); "bench" (Table 10). In Table 9, the word "furniture" was provided with the right answers by nearly 80 per cent of the subjects involved. This

Table 3

The Assigned Relationship: An Object and Its Use
 (The Pattern: "A House-to Live")

Assigned column of words	Subjects not warned (42 persons)			Subjects warned (46 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
school	100	—	—	100	—	—
ball	100	—	—	100	—	—
calendar	74	2	24	52	7	41
village	—*	62	38	—*	46	54
Moon	—*	71	29	—*	52	48

Table 4

The Assigned Relationship: A Verb and Its Direct Object
 (The Pattern: "To Write—A Letter")

Assigned column of verbs	Subjects not warned (47 persons)			Subjects warned (41 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
to draw	96	2	2	98	2	—
to listen to	85	13	2	88	7	5
to rest	—*	64	36	—*	27	73
to work	—*	55	45	—*	24	76
to measure	53	21	26	73	7	20

leads us to the conclusion that the subjects managed to understand correctly the instructions and the content of each specific task.

Nonetheless, certain "difficult" words were provided with erratic (illusory) answers by a great number of subjects, and such answers are especially numerous in the protocols of tests in which the subjects had not been warned that an answer was not possible in all the cases; thus, over 80 per cent of the subjects gave erratic (illusory) answers to the words "chess", "skates" (Table 1); "forest" (Tables 5 and 6); "lark" (Table 8); and about 50 per cent of the

Table 5

The Assigned Relationship: Antonymy
(The Pattern: "Peace-War")

Assigned column of words	Subjects not warned (41 persons)			Subjects warned (44 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
light	98	2	—	98	2	—
day	90	—	10	98	—	2
pencil	—*	51	49	—*	39	61
forest	—*	90	10	—*	66	34
native	71	7	22	70	2	28

Table 6

The Assigned Relationship: Antonymy
(The Pattern: "Cold-Heat")

Assigned column of words	Subjects not warned (47 persons)			Subjects warned (41 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
sorrow	92	4	4	94	4	1
mind	72	4	24	59	4	37
forest	—*	90	10	—*	50	50
spoon	—*	50	50	—*	29	71
copper	—*	50	50	—*	7	93

subjects, to the words "air", "hope", "wind" (Table 2); "village", "Moon" (Table 3); "to rest", "to work" (Table 4); "pencil" (Table 5); "spoon", "copper" (Table 6); "oval" (Table 7); "elephant" (Table 8); "passport", "jam", "telegram" (Table 9). In each of these cases subjects diverged from the relationship pattern of the column.

The warning that it is impossible to fulfil all the tasks leads to a considerable reduction of the number of illusory solutions. Notably, a much lesser number of subjects furnished the second word to the following assigned words: "hope", "wind" (Table 2); "to rest", "to work" (Table 4); "spoon", "copper"

Table 7

**The Assigned Relationship:
Positive and Comparative Degrees
(The Pattern: "Much / Many-More")**

Assigned column of words	Subjects not warned (47 persons)			Subjects warned (42 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
well	90	8	2	100	—	—
new	72	11	17	72	4	24
woolen	—*	30	70	—*	7	93
summer-time	—*	28	72	—*	7	93
oval	—*	64	36	—*	50	50

Table 8

**The Assigned Relationship:
A Living Being and Its Usable Product
(The Pattern: "A Sheep-Wool")**

Assigned column of words	Subjects not warned (44 persons)			Subjects warned (46 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
hen	94	3	3	100	—	—
bee	82	7	11	96	2	2
lark	—*	82	18	—*	39	61
elephant	11	57	32	26	28	46
apple-tree	84	14	2	96	4	—

(Table 6); "woolen", "summer-time" (Table 7); "lark", "elephant" (Table 8). However, this warning led to a greater percentage of omissions for words presupposing a pair, such as "air" (Table 2); "mind" (Table 6); "elephant" (Table 8); "passport", "jam", "telegram", "planet" (Table 9); "leather" (Table 10).

Yet, in many cases we came across a high percentage of illusory solution even though our subjects were aware of unsolvable problems. And especially great percentage of 'negative

Table 9

The Assigned Relationship: A Genus and Species
 (The Pattern: "Footwear-Shoes")

Assigned column of words	Subjects not warned (43 persons)			Subjects warned (46 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
furniture	78	11	11	83	6	11
passport	2	74	24	2	37	61
jam	14	65	21	22	26	52
telegram	12	51	37	13	35	52
planet	42	37	21	48	11	41

Table 10

**The Assigned Relationship: An Object and the Material
of Which It Is Made**
 (The Pattern: "A Note-Book-Paper")

Assigned column of words	Subjects not warned (47 persons)			Subjects warned (41 persons)		
	Correct answer	Erratic or illusory solution	No answer	Correct answer	Erratic or illusory solution	No answer
bench	96	4	—	98	—	2
stockings	88	6	6	93	5	2
glass	36	15	49	31	10	59
leather	11	38	51	19	12	69
knife	85	4	11	93	—	7

facts (75 per cent) was noted in Table 1 ("chess" and "skates"). In spite of the warning that it was impossible to solve all the experimental problems, illusory (erratic) solutions were provided by almost 50 per cent of our subjects who added the second word to the assigned words: "village", "Moon" (Table 3); "forest" (Tables 5 and 6); "oval" (Table 7).

Thus the *quantitative* data available in Tables 1 through 10 indicate that, on the one hand, the task was comprehended

by virtually all the subjects, while on the other, in solving difficult problems quite a few subjects missed the correct solutions which they invariably adhered to while solving "simple" problems.

Let us pass over to the *qualitative* analysis of illusory and erratic solutions. To begin with, we note that, as is evident from our data, it would be wrong to say that our subjects completely neglected the assigned relationship: each erratic answer bears a certain mark of the assigned relationship even though this relationship is not strictly observed.

Let us consider the column the relationship in which is determined by the pattern "a book—a writer" (Table 1). The word "picture" was invariably provided with a word denoting a creator of this particular object, namely, "an artist", and in two instances, "a producer" (this answer is also correct, for a producer is a creator of motion pictures) rather than words denoting people who may use a picture. Not a single subject resorted to the words "collector" or "movie-goer". In the same column, almost all the subjects provided the word "verses" with the word "poet", rather than "reader", "reciter", "performer", etc. The percentage of the correct answers to the word "theory" was somewhat lower, yet almost all the subjects saw fit to use "scientist", "theoretician", "scholar" rather than "lecturer", "student", "popularizer". To summarize this, even though the relationship between the words of the pattern "a book—a writer" was not formulated with sufficient clarity, all the subjects focused on a creator and not just on any man who may have something to do with the listed words. Meanwhile, in the same column, the assigned words "chess" and "skates" were supplemented with, respectively, "chess-player" and "skater", i. e., people who only use these objects. Therefore, the assigned relationship was somewhat broadened.

The column which began with the pair "snow—white" (Table 2) contained the word "coal" which was normally supplemented with the word "black", though in rare cases (two of the subjects) added to it the adjectives "red" and "gray" (which are, essentially, correct answers since these words denote color). The answers to the word "moss" revealed a much greater diversity of color hues: "green" (most frequent), "gray", "yellow-green", "light-green", and others.

At the same time, not a single subject provided the word "coal" with any epithets other than color, say, "heavy", "bright", "hard", "useful", etc., while only three subjects (less than 4 per cent) supplemented "moss" with the adjective "soft". The words

"wind" and "hope" were provided with adjectives which had nothing in common with color: "wind" was provided with "strong", "fresh", "gusty", and "hope" with "bright", "optimistic", "great", "illusory" and others. It would be of interest to note that some subjects were trying to make use of the words in this way or another associated with color, even though this association was allegorical: "bright", "illusory". What we have come across here is an interesting example of a *compromise* illusory solution.

Highly characteristic in this respect are the words attributed to the word "air". It was only in several protocols that we came across the word "blue", whereas quite a great number of subjects (nearly 30 per cent) responded with "colorless", which may also be qualified as a correct answer because the word implies a color characteristic. At the same time, about 40 per cent of the subjects used the word "transparent" which characterizes another quality of the object, albeit closely related to color as long as it, just as color, is associated with the visual modality of perception. (It is not improbable that a number of subjects regarded "colorless" and "transparent" as synonyms.) Also noticeable here is the broadening by a subject of the assigned relationship: a characteristic of an object from the point of view of special visual modality (color) is also replaced by a visual characteristic which, however, is no longer limited by the distinctive features of the first characteristic.

In the column which began with the pair "a house—to live" (Table 3), the "simple" words "school" and "ball" were almost unanimously provided with the verbs "to study" and "to play", although they (naturally, in defiance to the instructions) could be associatively provided with other verbs; for example, "to love", "to remember", to the word "school", and "to buy", "to present", "to kick", etc., to the word "ball". The word "calendar" featured an extremely low percentage of erratic answers (only 4 per cent) although the number of correct answers in comparison with other assignments was also low. This may be explained by the difficulty in trying to express the idea of a calendar's function. We have to note that answers which were qualified as correct also revealed a great diversity (e.g. "to learn the date", "to count the date", "to count the time", "to follow the count of days"). In this column, "village" was mainly provided with the verbs "to live" and "to rest" (the second answer vividly proving the reconsidered attitude to the assigned relationship), while "Moon" was provided with "to shine", "to research", "to look at", "to admire", "to watch", and other verbs denoting either the action of the object itself or the action directed at it.

The column in which the relationship between words was defined by the pattern "to write—a letter" contained the problem to select direct objects to the assigned verbs (Table 4). In this situation, when dealing with the verbs requiring a direct object, we may think of a great variety of nouns. The verb "to draw" was mostly provided with nouns in the Accusative Case as direct objects ("a picture", "a sketch", "flowers", "a portrait") rather than explanatory words, say "(to) a brother"^{*} (which is an indirect object), "quickly", "well", "with ink", etc. The majority of subjects also added direct objects to the verb "to listen to"^{**}, such as "music", "lecture", "opera", "broadcast", "story", "interlocutor", etc. (all of them being in the Accusative Case) rather than, say, "attentively", "with interest", "intently", etc.

Yet, the column shown in Table 4 contains a certain number of answers which may be qualified as erratic even though, to be exact, their usage is stipulated by a reconsideration of the relationship between the words included in the pattern, in which situation they may be regarded as correct. For example, in three protocols, subjects from different schools provided the verbs "to draw", "to listen to", "to work" and "to measure" with the nouns "drawing", "hearing", "work" and "measure" ("measurement"), respectively. The matter is that these subjects regarded the second word in the pattern "to write—a letter" as a noun which has the same root as the assigned verb.^{***} The same reconsiderations also took place in some other columns.

The number of correct answers given to the verb "to measure" (e. g., "length", "width", "depth", "volume") is considerably lower than to the verbs "to draw" and "to listen to", which may be attributed to the following two factors: (1) reconsideration of the assigned relationship which we discussed above; (2) "to measure" is preceded by two words which rule out correct solutions. In other words, the preceding illusory solutions had a detrimental effect on the solution of this task.

In case of the intransitive verbs "to (have a) rest" and "to work", subjects selected indirect objects and modifiers, since the use of direct objects was inconceivable. The word "to work" was provided with "at a factory", "in a lab", "for the people", "well"; and the word "to (have a) rest", with "joyously", "in the forest", "at the sea-side", "conscientiously", etc. Thus, this

* Dative case in Russian.—*Tr.*

** This verb is transitive in Russian.—*Tr.*

*** In Russian, the words "to write" and a "letter" have the same root ("pisat'"—"pis'mo").—*Tr.*

particular case (subjects were instructed to provide a direct object) was replaced by a more general grammatical category: any secondary member of a sentence.

In the present experimental series, two columns required that subjects select antonyms to assigned words (Tables 5 and 6). "Day" invariably was accompanied by "night", "light" by "heavy" and, rather seldom, by "difficult" (both answers being correct in Russian), "sorrow" by the "joy" and sometimes by "hilarity". More diverse, yet essentially correct answers were provided to the assigned words "native" and "mind". "Native" was counterposed by "foreign", "from abroad", "overseas", "imported"; and "mind", by "stupidity", "dullness", "madness".

The words which had no antonyms were provided with the words denoting various adjoining concepts which may be, to a certain extent, regarded as counterposed to the assigned concepts. The word "pencil" is most frequently counterposed by "pen" (it writes differently) and, from time to time, by "rubber" or "eraser" (it serves to perform the opposite act: to remove what has been written); "spoon" is often counterposed by "fork" and seldom by "knife" (they perform acts which cannot be performed by a spoon); "copper" by "steel" (which is a stronger metal).

Of special interest are the answers given to the word "forest"; added to it were the words denoting various qualities opposed to those suggested by this concept, namely, "a lawn", "desert" (absence of vegetation), "steppe", "field", "meadow" (a different kind of vegetation), "a park" (man-made plantations), "a grove" (less dense woods), "a jungle" (thicker and wild woods), "a tree" (a single object opposed to a multitude) and even "a river", "sea" and "plain" (a different type of landscape).

Such answers reveal the subjects' wit since they managed to discover such facets of the assigned concepts to which the opposite notions could be found. Yet, the subjects failed to observe the requirements of the instructions completely. In fact, the pair of words which serves as a pattern reveals *polar* opposition, which is fully realized by the subjects as well: they provide the concept-word "day" only with its diametrically opposite concept "night" and not any other co-subordinated and partly opposite concepts, such as "morning", "evening", "month", "hour".

Consequently, the subjects were sidestepping the instructions only when they were experiencing a difficulty, although they sought to preserve the trend to at least partial observance of the assigned relationship.

A column the relationship in which was defined by the pair "much / many—more" (Table 7) contained a clearly specified task: to provide adverbs and adjectives with their comparative degrees. Judging by the answers to "simple" words, this assignment was comprehended correctly by practically all the participants: "well" was provided with "better" (there were two instances of the usage of "excellent" and one usage of "beautiful"), and "new", with "newer", "more new".

As is evident from Table 7, there were a great number of subjects who also tried to find a solution for relative adjectives which have no degrees of comparison. In such illusory solutions, the grammatical objective was substituted with a lexical one, and the answers reveal certain traces of the first objective since in making a selection of adjectives, subjects were amplifying a specific quality. Thus, "woolen" was accompanied by "fur", "purely woolen", "Boston" (the best-quality woolen fabric), and "summertime", by "hot" and "beach-type".

In the same column a number of subjects (about 30 per cent of those involved in the test and almost 50 per cent of those who gave illusory answers) supplemented "oval" with "circular", by which way they introduced a new word instead of altering the grammar of the assigned word. There were cases when the subjects made grammatical transformations in the new word, in particular, entering the words "more circular".

Thus, the amplification of quality, as required by the instructions, was to be effected through grammatical means; the subjects who illusorily replaced one word by another achieved this by lexical means. Consequently, we again come across the *neglect* of distinction which we have already noted (in this column we can see this neglect between two main ways of expressing one or another quality: grammatical and lexical).

The neglect of distinction and the omission of limiting qualities is especially conspicuous in the example of problem-solving in the column provided with the pattern "a sheep—wool" (Table 8). Judging by the correct answers given to "simple" words, the subjects, certainly, focused on the useful material products obtained from animals and plants. Thus "hen" was almost invariably accompanied by "down", "meat", "feathers", "eggs" (all of these answers being correct) and "bee", with the correct answers "honey" and, in several cases, "poison" and "wax". The word "apple-tree" was almost exclusively provided with correct answers: mostly with "apples", and sometimes with "fruit", though in one case it was accompanied by "wood". It is noteworthy that not a single subject provided "apple-tree" with "decoration", "shadow",

"bloom", i.e., they only were concerned with the material products we may obtain from the apple-tree.

A total of 42 per cent of our subjects provided the word "lark" with "song", and "singing". In this case, the subjects were regarding usefulness in the broader sense of the word without confining themselves merely to material products. Highly characteristic in this column were the answers given to the word "elephant"; alongside "beavers" and "ivory" (correct answers) there were also a great number of such answers as "toil"; "labor", "strength" and even "show".

Many subjects experienced great difficulties in solving the problem which required that they select species concept to the assigned generic concept (the pattern being "footwear—shoes"). Table 9 shows that it was only to the assigned word "furniture" that the majority of the subjects (80 per cent) provided correct solutions, for example, the words "table" (most frequent), "wardrobe", "chair", "cupboard", "sofa", "bed". Yet, even this word was provided with much broader concepts, such as "interior", or "household objects". The other words of this column were usually provided with generic concepts rather than species concepts. About 43 per cent of the subjects entered the word "document", "identification card" and "booklet" to supplement the word "passport". And only one subject gave the correct answer: "personal". The word "jam" alongside the correct answers ("apple", "strawberry", "apricot", "raspberry"), was provided by many subjects with words denoting more general notions: "food", "meals", "sweet-stuffs", "dessert", "treat". The word "telegram" was provided with correct answers by only a few (12 per cent) subjects ("congratulatory", "flash", "facsimile", "holiday", "urgent"); the other answers included concept-words with a broader connotation: "message", "means of communications", "communiqué", "news", "notice". In this column, even the word "planet" presented difficulties, and correct answers were provided by less than 50 per cent of the subjects who mentioned some planets of the Solar system; some others, on the other hand, were providing much broader concepts, such as "celestial body", "cosmic body". Remarkably, the overwhelming majority of subjects gave alternatively correct and erratic solutions. Consequently, a replacement of one relationship (species) by another (generic) may not be associated with the subjects' reconsideration of the assignment (pattern) as a whole. We would like to note that the relationship of genus and species between the assigned words, though "upturned", was preserved even in erratic solutions. A question arises whether this may be explained by the

peculiarities of a given logical relationship or it reveals a more general psychological law.

Let us now consider the results of problem-solving in the column where the assigned relationship was determined by the pattern "copy-book—paper" (Table 10). The overwhelming majority of subjects gave correct answers to three of the five assigned words by denoting the material of which a particular object is made. "Bench" was provided with "wood" (the most typical answer) and "boards". "Stockings" was provided with "material", "knitwear", "capron", "threads", "wool" and "fabric". And "knife" was accompanied by "metal", "steel" and "iron". All this leads us to the conclusion that all the subjects properly understood the assigned relationship. Nonetheless, alongside the correct answers the two remaining words of this column were provided with the words denoting the products for which this object serves as primary material. Thus, the assigned word "glass" (material.—Tr.) was provided not only with the words "sand", which is a correct answer, but also with "a glass", "window" and "bottle"; and "leather", with the correct word "hide" as well as with the illusory words "footwear", "boots", "shoes" and "bag". In the same way as in the above test which required species concepts be chosen for generic concepts, we observed in this column a similar "upturning" of the assigned relationship; individual subjects showed what could be made out of an object instead of what it is made of.

The assigned relationships of the last two columns ("footwear—shoes" and "a copy-book—paper") presuppose a strictly definite orientation: in the first case, directed from the generic concept to the species one (and not vice versa); in the second case, from a product to its primary material. In erratic solutions, the *aspects* of the relationship are preserved but the *direction* of the transition changes. This means that in solving the difficult problems of these two columns, some subjects ignored the assigned direction of the transition from one aspect of the relationship to another. In extremely rare cases, we also observed a neglect of the very aspects of the relationships. For example, in working with the column which required that subjects select a species concept, one subject provided the word "telegram" with "address", and several subjects, with "words", while "planet" was provided with "life". In this test, the relationship "genus-species" was replaced by the relationship "whole and its part" and by the relationship "object and one of its characteristics". To a certain extent, even such a replacement has preserved some signs of the primary relationship: a transition from something big to something small.

Let us summarize the results of the first experimental series. Practically all the subjects managed to understand correctly the assigned relationship, which in itself is an important characteristic of an experimental task, even though it (the relationship) was not formulated plainly and explicitly, being presented as a pattern: a determining pair of words at the beginning of each column.

The numerous erratic or illusory solutions revealed in the course of the experiment cannot be qualified as resulting from optional substitution of one task by another, from a wrong set or reluctance to fulfil a task.

As a result of a thorough analysis of negative facts we have every reason to conclude that a subject regarded erratic or illusory solutions as correct since in the majority of cases deviations from assigned relationships were *minute* and *hardly noticeable*. Especially typical in this respect are the compromises when, for example, in compliance with the instructions to specify color, a subject provided the word "hope", allegorically, with adjectives "bright" and "illusory", which can justly be attributed to color characteristics. Finally, it is important to note that negative facts take place even though subjects have been warned that it is impossible to provide answers to all the words of the column. Although such a warning, certainly, reduces the number of negative facts, they are not completely eliminated, and preserve *the same qualitative peculiarities* of the negative facts revealed without a warning.

Consequently, negative facts may not be explained by the above reasons. Obviously, they are determined by a more subtle internal mechanism. Though the experimental tasks were different in character (logical, grammatical and lexical problems), we have to emphasize the common feature of all the negative facts. In each case of illusory or erratic solutions we observed *discardings* and *omissions* of various limitations, neglect of the distinctive features characterizing the assigned relationship.

In our opinion, the data we have obtained expose a highly essential intrinsic law of mental activity which we would like to define by the term "*anaxiomatization*" (from Greek, the negation "*an*" and the root "*axio*", "recognize", "evaluate"). Anaxiomatization implies *devaluation* of various kinds of information as well as of various techniques. As is evident from the facts we have considered, anaxiomatization occurs each time when a subject has to back away from a purely reproductive method of fulfilling an assignment, confronting an impediment, no matter the reasons for the latter, objective or subjective. The anaxiomatization, which we identify with an immanent

internal mechanism, should invariably and ineluctably manifest itself in the conformable problematic situations, although it may assume various forms; in other words, it may have different directions.

It is true that in the solutions of certain problems we observed a neglect of various limiting aspects, which resulted in a relative broadening of the assigned relationship (Tables 1 through 8); the solutions of other problems revealed a devaluation of the direction of the assigned relationship, which led to "upturned" relationships (Tables 9 and 10). An axiomatization is not rigidly predetermined, and it may affect any aspect. We observed especially vivid manifestations of this in the examples of subjects' selecting false antonyms to the word "forest". The discarding of these or other features produced a great diversity of illusory solutions.

However, if the mechanism of an axiomatization proposed by us is a real objective law, it should manifest itself not only in negative but also in positive facts. Naturally, correct fulfilment of experimental tasks also presupposes devaluation and discarding of unsolvable problems as senseless. This places the positive facts (externally manifest in the blanks against the words which may not be provided with another word) in dependence upon the mechanism of an axiomatization, even though the latter is directed at the problem as a whole rather than at its conditions.

It would be correct to regard as a special intermediate phenomenon the few facts when the subjects sought to provide a rational solution to a problem by devaluating the "conventional" ("commonly accepted") sense of a column's pattern, imparting to it a different meaning (for example, we could observe that the second word of the pattern "to write—a letter" was not interpreted as a direct object to the verb, but as a noun which has the same root with the verb).

Thus, the mechanism of an axiomatization which was revealed in this experimental series enables us to explain not only the negative facts we have observed but also phenomena which suggest the correct way out of a problematic situation, i.e., positive facts.

THE SECOND EXPERIMENTAL SERIES

In the experiments we have already described, the mechanism of an axiomatization manifested itself only when the subjects found themselves in difficult (objective or subjective) situations. We could see that in a great variety of cases an axiomatization

produced illusory or erratic solutions; yet there were other cases when it provided a correct heuristic way out of a problematic situation. However, conceding that this mechanism was revealed under specific conditions, one could form the impression that it was, from beginning to end, determined by the peculiarities of the particular task which interfered with a subject's strict, logical way of thinking compelling him to discard certain limitations that obstructed the accomplishment of his assignment. Moreover, the only correct way out of a problematic situation (determined by the instructions to solve an unsolvable problem) consists precisely in the anaxiomatization of the task, i.e., in its devaluation as senseless.

This could allow us to regard anaxiomatization as a partial law. The universality of anaxiomatization mechanism would be confirmed if we discovered it in solving problems which do not presuppose the above-mentioned rigid conditions and make it possible to comply with the 'demands of logic.'

Given that the objective laws of the psyche can in principle be traced in any material, this series of tests as well as the preceding one was based on semantic material since it does not involve any special knowledge or skill of the subject, nor complex experimental procedures.

In the preliminary experimental task which we described earlier (70), the subjects were asked to group 30 words (using the following word-sets: concrete nouns, abstract nouns, verbs and adverbs) without instructing them as to the character and methods of organizing the words. This task is simple, therefore it does not put the subjects in situations typical of the experiments carried out in the first series. Prevalent in the list of words offered for grouping were words that form "compact" sense groups; yet alongside these there were words posing as *alien* elements. This experiment proved that the subjects often included such alien elements in the compact groups they were forming, for example (the alien elements being emphasized), *ears, shoulders, eyes, the mouth, the forehead* (the bulk of the nouns denoting various facial features); *a perch, a horse, a pike, a carp* (the bulk of the nouns denoting fishes), etc.

In conclusion, in solving solvable problems, namely, in the process of grouping, we may also observe the devaluation of some features, which enables us to organize into one group the words which logically have to be attributed to different groups.

However, the facts we have described may be interpreted differently without using the concept of anaxiomatization, viz. the inclusion of alien elements in compact groups may simply

be explained by the fact that the subjects were basing their classifications on broader features. In the examples we have provided such features were, respectively, "a part of the body" and "an animal". Even though this interpretation fully agrees with our conception of the anaxiomatization mechanism, the role of the latter in revealing alien elements would have been convincingly proven only provided this phenomenon were also observed in the situations when the subjects could avoid this by organizing words on a broader basis.

We selected the experimental material for this series guided by this particular consideration. Our experimental list of words contained 30 nouns, the bulk of which formed three basic *groups* divided, in turn, into two *subgroups* and one so-called *critical* word lying actually (and logically) beyond the limits

Word-Set I

	Group 1	Group 2	Group 3
SUB-GROUP	the eyes the ears the nose the lips the cheeks	a swallow a bullfinch a sparrow	a trolley-bus a bus a streetcar an airplane
SUB-GROUP	the elbow the foot the shoulder the wrist the knee	a mouse a rat a gopher	a fork a knife a ladle
CRITICAL WORD	the tongue	a frog	a lathe

The neutral words: the Sun, a book, wheat, a chair.

Word-Set II

	Group 1	Group 2	Group 3
SUB-GROUP	a zander a pike a carp a perch a sheat-fish	a drill-bit a file a cold-chisel a chisel	a sofa a wardrobe a table

	Group 1	Group 2	Group 3
SUB-GROUP	a butterfly a bee a dragon-fly an ant a grass-hopper	a mains-socket wire a switch a knife-switch	a drop-curtain blinds a curtain
CRITICAL WORD	a swallow	a lock	a picture

The neutral words: a tree, a glass, a plate (the last two words are organized into a small group).

Word-Set III

	Group 1	Group 2	Group 3
SUB-GROUP	a camomile a forget-me-not a carnation a chrysanthemum a gladiolus	an armchair a wardrobe a table a chair a sofa	a book a magazine a booklet
SUB-GROUP	an alder an ash an oak a birch a lime	a wine-glass a glass a cup a plate a saucer	a parcel a letter a telegram
CRITICAL WORD	beet-roots	a lamp	a folder

The neutral word: a lark

of these subgroups. Besides, the list contained one or several so-called *neutral* words which could not be attributed to any group.

Presented above is the internal structure of the three experimental word-sets issued to the subjects for grouping.

In the experimental list given to the subjects the words were arranged at random; the subjects, naturally, were not familiar with the internal structure of the word-sets.

The subjects of the experimental series were the 9th- and 10th-form students of Minsk schools. The instructions which were read aloud by the experimenter were as follows: "Each one of you will receive a card with a list of 30 nouns. After you have carefully read them, you will notice that these nouns can be organized into groups. Your task is to write groups of these words on individual sheets of paper; organize the words according to the best principle you can think of. The word groups may be recorded either in column or in line. You can make amendments. Do not sign the sheets. Ask all your questions before you begin working with the task, and do not ask any questions thereafter. I ask you to be thoughtful and conscientious while fulfilling the task."

In the processing of the experimental material we took into account only the cases (the overwhelming majority), totally 108 protocols, where our instructions had been observed.

How were critical and neutral words re-arranged as a result of grouping? These data may be found in Tables 11 through 13.

The fulfilment of the task was qualified as correct when neutral and critical words were written separately, as well as when the critical words were included in the conformable groups. The fulfilment of the task was considered erratic when critical words were included in subgroups or / and when neutral words were included in groups and subgroups (alien elements).

We qualified as extraordinary each unpredictable grouping; above all, such were the cases when individual words included in subgroups were combined with critical or / and neutral words, for example, a combination into the same group of the words

Table 11

The Arrangement of Critical and Neutral Words in Set I
(per cent of the total number of protocols—35)

The critical or neutral word	Not included in protocol	Correct fulfilment		Included as alien element	Extra-ordinary grouping
		Included in the group	Recorded separately		
the tongue	—	80	—	20	—
a frog	—	43	3	54	—
a lathe	3	7	23	60	7
a book	3	—*	37	43	17
wheat	6	—*	37	20	37
a chair	3	—*	20	63	14
the Sun	6	—*	34	17	43

Table 12

The Arrangement of Critical and Neutral Words in Set II
 (per cent of the total number of protocols—36)

The critical or neutral word	Not included in protocol	Correct fulfilment		Included as alien element	Extra-ordinary grouping
		Included in the group	Recorded separately		
a swallow	3	14	25	29	29
a lock	6	11	17	55	11
a picture	6	43	17	31	3
a tree	14	—*	36	25	25

Table 13

The Arrangement of Critical and Neutral Words in Set III
 (per cent of the total number of protocols—37)

The critical or neutral words	Not included in protocol	Correct fulfilment		Included as alien element	Extra-ordinary grouping
		Included in the group	Recorded separately		
beet-roots	19	16	51	11	3
a lamp	3	5	19	70	3
a folder	5	51	16	28	—
a lark	14	—*	77	3	6

* The asterisk signifies that this word may not be included in the group.

denoting birds and flying insects: "a swallow", "a butterfly", "a dragon-fly", "a bee" (Word-Set II). We regarded as extraordinary the cases when the subjects combined neutral words (e.g., "the Sun"—"wheat", Word-Set I).

This experimental series also revealed the presence of alien elements in groups and subgroups, as we observed in the preliminary investigation. All the critical and neutral words, without exception, were included in groups and subgroups. Especially frequent words used as alien elements were "a frog", "a lathe", "a book", "a chair" (Table 11); "a swallow", "a lock", "a picture" (Table 12); "a lamp", "a folder" (Table 13).

The presence in subgroups of alien elements which we observed in this series cannot be explained by the classification on a broader basis (which we, seemingly, could resort to for explaining the analogous facts in the preliminary investigation), since the critical words in the groups formed as a result of this classification do not represent alien elements. The use of a broader basis for classification provides no explanation for the inclusion of neutral words in groups and subgroups either. It would also be wrong to attribute the facts we have described to the subjects' negligent attitude* to their tasks or to their insufficient differentiation of experimental material: students of senior forms, undoubtedly, know perfectly well that, say, a frog is not a rodent, and a swallow is not an insect. Nonetheless, more than a half of the subjects who worked with Word-Set I entered a frog along with rodents, and about one-third of the subjects who worked with Word-Set II entered swallow along with insects (see Tables 11 and 12). Such grouping would only be possible if specific distinctive features were neglected. In other words, it is nothing other than an axiomatization (devaluation) of various essential conceptual aspects that allowed the subjects concerned with them to introduce both critical and neutral words into groups and subgroups.

We have thus seen that the mechanism of an axiomatization exposed in the first experimental series, while analyzing the results of unsolvable problems, is not "local"; it applies to solvable problems equally well. The universality of the an axiomatization mechanism is also confirmed by the fact that its effect is traceable not only in the cases of erratic groupings (alien elements in groups and subgroups), but also in any other, including correct, acts of grouping.

J. Bruner, J. Goodnow, and G. Austin once said that to group individual objects into classes (to categorize) is to render "discriminably different things equivalent" or to respond to them "in terms of their class membership rather than their uniqueness" (134, 1).

In other words, to categorize means to neglect individual peculiarities of the grouped objects and to devalue their uniqueness. Thus, the psychological characteristic of the process of grouping proposed by J. Bruner and his colleagues contains

* The subjects' desire to fulfil a task correctly shows, in particular, in the so-called extraordinary ways of grouping which may be qualified as intermediate between the correct and the erratic solutions. Thus almost in 30 per cent of the conformable protocols the word "swallow" was combined with the words denoting flying insects.

a vague reference to the mechanism of anaxiomatization*.

As we have already noted, a recognition of a special psychological mechanism of mental activity is reasonable only when this mechanism can explain both positive phenomena which strictly comply to logical requirements** and negative phenomena which run counter to such requirements.

The hypothesis we rely on which holds that groups of objects are organized into classes by anaxiomatization of their "uniqueness features" also suggests that other features of the grouped objects may undergo devaluation, in particular, the features which help differentiate bordering classes and categories. In the latter case we may observe the presence of alien elements in the group and subgroup.

In addition, it would be reasonable to presume that the anaxiomatization mechanism serves to precondition the following quantitative effect. When a subject has adequately differentiated knowledge of the objects to be grouped, it would be easier for him to organize them into small groups than into large groups because less "uniqueness features" are devalued in the former case. In other words, we may expect that in the protocols subjects would organize objects into subgroups rather than into groups. This trend is supported by facts (discussed below). At the same time, we would like to note one more peculiarity of the mechanism of anaxiomatization, namely, its *non-predetermined* orientation. The non-predetermined character of anaxiomatization implies a possible devaluation of *any* of the object's features in the course of productive activity. The phenomenon we have considered—alien elements in groups and subgroups—brings us close to the idea of non-predetermination since we find proofs that logically sound and unsound anaxiomatizations may successfully coexist. Especially illustrative in this respect is the use by *one and the same* subject of *different* yet logically equally sound, ways of accomplishing *one and the same* task.

In studying various mnemonic phenomena, we used to prove

* At the same time, we find absolutely unacceptable the philosophical approach to the process of categorization taken by these authors. Asked whether "such categories as tomatoes, lions, snobs, atoms and mammals exist?", J. Bruner and his colleagues answered: "In so far as they have been invented and found applicable to instances of nature, they do. They exist as inventions, not as discoveries" (134, 7). We come across here an explicit subjective-idealistic, Machist conception.

** The psychological aspect of the problems of generalization, abstraction and concept-formation of notions will be considered in Chapter V.

the non-predetermined character of the process of recollection by comparing multiple reproductions by the subject of one and the same material which he had memorized. This provided us with sufficient facts to advance the probabilistic conception of recollection (66). However, such an approach (the use of one and the same material) may not be applied to the analysis of fulfilment of *productive* tasks since repetitive solutions may eventually be reduced to a mere reproduction of previous tasks. Besides, as we will prove later, the successful fulfilment of a task prevents us from seeing other solutions. Therefore, we may prove the non-predetermined character of an axiomatization only by comparing the results achieved in accomplishing an identical task by one and the same subject, the tasks being based on different materials.

In this experimental series, the subjects had to organize words belonging to three groups, each consisting of two subgroups. Table 14 presents the distribution of protocols depending on the principles of grouping words.

Table 14
Principles of Grouping Words
 (per cent of the number of protocols per word-set)

Word-Set	Unitype grouping		Multi-type grouping	
	Groups	Subgroups	into groups and subgroups	
			2 groups and 2 subgroups in protocol	1 group and 4 subgroups in protocol
I	3	16	43	38
II	6	45	9	40
III	5	40	8	47

Table 14 shows, first and foremost, the subjects' preference to organize words in subgroups rather than in groups: on average, in 34 per cent of all the protocols the words were organized exclusively into subgroups, while only in 4 per cent of the protocols, exclusively into groups. At the same time, in analyzing the protocols containing both groups and subgroups, we discovered that the number of protocols featuring only one group and four subgroups prevailed over the rest of the protocols (42 per cent

of the total of protocols against 20 per cent of the protocols featuring two groups and two subgroups).

Furthermore, another tendency becomes apparent. This is the use of both principles of grouping words by the same subjects. Table 14 shows that only 38 per cent of all the subjects resorted to unitype grouping (the protocols feature either, exclusively, groups or, exclusively, subgroups) yet, the majority of protocols (62 per cent) are characterized by multi-type organization of words into both groups and subgroups. Given the probability that multi- and unitype grouping is proportional to the number of possible combinations of principles of organizing words, the hypothetical probability of unitype grouping amounts to 0.25, and of multi-type grouping, to 0.75.* Thus the actual number of multi-type grouping (62 per cent) closely approaches the theoretically possible number of such cases, the latter amounting to 75 per cent in compliance with the considerations of probability we have provided.

Consequently, the protocols provided by the same subjects who accomplished the same task, often (83 per cent of the total of theoretically possible cases) reveal *different* results of anaxiomatization (groups and subgroups), which is another confirmation of its non-predetermined character.

THE THIRD EXPERIMENTAL SERIES

The first and the second experimental series revealed the mechanism of anaxiomatization which consists in devaluating either information or ways of fulfilling a task. In more general terms, we were dealing with a *shift* in evaluation. Yet, shift may not only imply a decrease of evaluation but also an increase. In order to ascertain that evaluation increases in the course of mental activity, it is obviously necessary to create an experimental situation which, first, would require that a subject *repetitively perform* an analogous task, and second, would enable him to resort to *different ways* for accomplishing such a task. If a subject who finds himself in such a situation relies on but a few of the available ways, it would be reasonable to presume that they have acquired an increased value.

* Our experimental material implies eight combinations of this kind: two combinations for a unitype organization of words (into groups or into subgroups), and six combinations of multi-type grouping (three variants of forming two groups and two subgroups, and three variants of forming one group and four subgroups). Consequently, the hypothetical probability of unitype grouping will amount to $2/8 = 0.25$; the hypothetical probability of multi-type grouping will equal $6/8 = 0.75$.

Such a situation takes place, in particular, when a subject has to fulfil a task using one of the traditional methods of studying phantasy, i.e., composing a great number of sentences which have to include mandatorily three assigned words (See Chapter III). Sentences and plots were usually composed on the basis of reference words to determine a subject's individual peculiarities, the originality of his mind, type of visualization, etc. (204).

Our experiments, aimed at revealing the intrinsic laws of phantasy, use these methods to establish the practical ways of realizing a choice. In this experimental situation, the subjects were practically unlimited in making a choice since every grammatically sound sentence containing the three assigned words fully complied with the requirements of the instructions. In other words, the conditions of the task itself do not presuppose a rigidly uniform solution.

Yet, strictly speaking, this experimental situation imposed certain limitations on the subjects: sentences had to be construed grammatically correctly and have a definite meaning. However, in spite of these limitations, the subjects had enormous opportunities for accomplishing the experimental task.

We selected the subjects of our experiments among 10th- and 11th-form students from seven schools in Minsk, one school in Mogilev, and two schools in Klimovichi, Mogilev region. Each subject was issued a card containing three nouns. All told, we used ten different word-sets:

- I. a star, a cloud, a book
- II. an apple, a room, an armchair
- III. a house / home, a flight, knowledge
- IV. a key, earings, a smile
- V. happiness, verses, a dance
- VI. a horse, a field, a city
- VII. the Sun, a telegram, sugar
- VIII. a sailor, a mirror, nuts
- IX. work, a library, a lamp
- X. an argument, evening, a store

The orally announced instructions read: "We would like to ask you to compose fifteen sentences during one lesson, and each sentence has to contain all the three words available in your card. Your sentences can vary both in content and in construction; the assigned words may be changed grammatically in case and number, yet their presence is mandatory in each sentence. It goes without saying that your sentences should be grammatically correct and have a definite meaning. Spelling

and punctuation will not be taken into account." No examples were offered in order that the subjects' way of thinking not be affected. The tests were performed anonymously.

A number of protocols contained many original and witty sentences, while we also came across primitive and banal sentences. However, we were not as much interested in the aesthetic value of the composed sentences as we were in the internal mechanisms of the process of phantasy; therefore, all the conscientiously fulfilled tasks are equally significant in this case.

With the understanding that in staging this experimental series we sought to expose the phenomenon of increased evaluation, we have to analyze the data which could enable us to assess the subjects' preferences and their peculiarities, namely, the data pertaining to (a) the dynamics of relationship between the three assigned and the involved (i.e., the remaining) words in the composed sentences throughout the whole protocol; (b) the dynamics of relationship between the assigned words themselves; (c) the repetitiveness in one and the same protocol of the involved words which served for "dovetailing" the assigned words in sentences.

Let us begin with consideration of the dynamics of relationship between the assigned and the involved words. In order to meet the requirements of the instructions, in building his sentence a subject could either subordinate the three assigned words to the involved words (the so-called *passive* construction) or employ the assigned words as a logical subject (the *active* construction). The active construction is also inherent in the sentences in which the role of a logical subject is played by only two and even one of the assigned words, which subordinate both the other assigned words and the involved words.

The previous analysis of the dynamics of relationship between the assigned and the involved words revealed the quantitative ratio of passive and active constructions per protocol (79): our facts exposed a definite tendency: in the overwhelming majority of protocols (96 per cent) the assigned words were mostly used either as subjects or as subordinate members of a sentence. In other words, in almost all the protocols, one of the probable constructions *prevailed* to prove the *preference*, the increased evaluation of one or another possible way of fulfilling the instructions (79, 52-53).

However, the dynamics of relationship between the assigned and the involved words may be exposed completely only by way of determining the *stability* of one or another construction throughout the whole protocol. Quite understandably, the stability of any

specific construction cannot be discussed unless it has recurred several times in a row. The more frequently a subject employs one and the same construction, the more *compactly* sentences with the same construction are arranged in the protocol. Thus, compactness, which is the expression of preferences in the selection of a particular construction, is characterized by the frequency, density of its recurrence in the protocol.

We find it necessary to provide a statistical footing to the hypothesis of the emergence of increased evaluation of productive thinking ways (in our case, of one or another construction). This involves the construction of a diametrically opposite hypothesis according to which a selection of each construction is accidental.

The analysis of the protocols has proved that the total number of sentences with passive constructions was approximately the same as the total number of sentences with active constructions (47 per cent and 53 per cent of all the protocols respectively). Consequently, each construction may appear in the whole scope of sentences under consideration with equal probability. This enables us to deduce the exact definition of the opposite hypothesis: both active and passive constructions emerge in the protocol accidentally with equal probability ratio of 0.5, the construction of one sentence being *independent* from the construction of the preceding sentence.

How can we make a quantitative estimate of compactness both probable, in line with the opposite hypothesis, and real, which we discovered in the protocols?

We would like to begin by presenting in full two protocols which we would use in the future analysis to illustrate the methods of processing experimental results (the Roman number in parenthesis denotes the number of the assigned word-set).

Example 1 (III)

1. I was invited to the House of Radio to attend a lecture about space flights and the cosmonauts' knowledge and skills in controlling a spacecraft.

2. Imagine, how much knowledge is needed to be able to build a house or to make a flight in a rocket!

3. I am fond of reading books about flights, about house construction and about the great knowledge of Soviet scientists.

4. Speaking at the party were a pilot and a construction worker who told us about flights, house construction and the knowledge indispensable for their deeds.

5. Can a construction worker build a house or a pilot accomplish a flight without adequate knowledge?

6. All the people of our country celebrate the Day of Construction Workers who build such beautiful houses, and the Day of Cosmonauts who were the first to accomplish flights into the Universe.

7. Knowledge and skill are needed everywhere: to accomplish a flight or to make a model of a new house.

The protocols contain seven sentences, in the first six sentences the assigned words being subordinate to the involved words (passive construction) and in the seventh sentence vice versa (active construction).

Example 2 (II)

1. In the room there was an armchair with an apple on it.

2. The armchair with an apple on it was in the room.

3. In the room there was an armchair with apples pictured in the upholstery.

4. The apple which had fallen off the armchair was rolling across the room.

5. In the room in which they had brought me I saw a man reclining in an armchair and a vase full of apples on the table.

6. He reluctantly rose from the armchair and took the apples to the adjoining room.

7. I like to sit in the armchair in front of the only window of my room watching the street with a continuous flow of automobiles illuminating the roadway by the golden apples of their headlamps.

8. The explosion was so strong that it shook the walls of the room, the wardrobe, the armchairs and the table, and overturned a vase full of apples on the table.

9. The blow was so strong that it sent him together with the armchair and an apple in his hand flying out of the room.

10. The apple thrown by someone into the window of his room landed in the armchair.

11. In this room I hid myself behind an old armchair and devoured the apples I had stolen.

The second protocol contains 11 sentences, the first four sentences having an active construction, the next three sentences, a passive construction, while in the remaining sentences the constructions alternate.

The compactness of the protocol may be presented as an ordered set of the natural numbers

$$(a_1, a_2 \dots a_k),$$

where a_i ($i = 1, 2, \dots, k$) signifies the number of adjoining sentences having the same structure. Correspondingly, the compactness of the above protocols may be presented as follows:

Example 1: (6, 1). Example 2: (4, 3, 1, 1, 1, 1).

In order to effect the quantitative estimate of the protocols' compactness, we would like to introduce a conventional value which we would like to identify as the *measure of compactness* (μ), which may be calculated using the following formula:

$$\mu = \frac{\sum_{i=1}^k d_i}{\sum_{i=1}^k a_i}, \quad (1)$$

where $d_i = 1 + 2 + \dots + a_i$ (the sum of succeeding natural numbers from 1 to a_i , inclusively); the denominator of the formula, which is always equal to the number of sentences in the protocol, serves as a normalizing multiplier.

By using this formula (1), let us try to calculate the measures of compactness of the protocols we have presented as the examples.

$$\text{Example 1: } \frac{1 + 2 + 3 + 4 + 5 + 6 + 1}{7} = 3.1$$

$$\text{Example 2: } \frac{1 + 2 + 3 + 4 + 1 + 2 + 3 + 1 + 1 + 1 + 1}{11} = 1.8$$

These examples indicate that the greater the number of adjoining sentences having the same construction, the higher the measure of compactness (Example 1); on the other hand, the measure of compactness is reduced by frequent alternations of the type of construction (Example 2).

When compactness is the smallest (when the protocol does not contain adjoining sentences having the same construction), its measure equals 1 (the bottom line of the measure). When the measure equals 2, compactness finds its expression in the protocol, for example, when the protocol contains six sentences each construction is repeated three times in a row.

We made a statistical analysis of the protocols containing at least five sentences (192 protocols). All the protocols were divided into three groups: group *A* included 61 protocols with five to seven sentences; group *B*, 86 protocols with eight to twelve sentences; group *C*, 45 protocols with thirteen to fifteen sentences.

We used our formula (1) to calculate the measures of compactness for all the protocols we have specified, which provided us with four experimental distributions of the measures of compactness: general distribution and distributions for groups *A*, *B*, *C*.

In compliance with the opposite hypothesis which we discussed above, we performed three *theoretical* distributions of the measures of compactness: distribution "a" based on the assumption that a protocol contains six sentences (the average number of sentences in the group *A* protocols); distribution "b" for the protocols containing ten sentences (Group *B*); and distribution "c" for the protocols containing fourteen sentences (Group *C*).

Table 15

**The Relative Frequency of Experimental
and Theoretical Distributions
of the Measures of Compactness
(per cent)**

Limits of intervals	Distributions						
	Experimental for Group A	Theoretical "a"	Experimental for Group B	Theoretical "b"	Experimental for Group C	Theoretical "c"	General experimental
1-1.25	16.5	19	6	7.4	4	7	9
1.25-1.55	16.5	34.5	26	31.9	20	29	19
1.55-1.85	16.5	19	15	27	27	27	21
1.85-2.15	26	12.5	16	15	13	17	18
2.15-2.45	3.25	6	17	8	9	9	10
2.45-2.75	3.25	4.5	3	5	9	4.5	5
2.75-3.05	8	1.5	4	1.4	2	2.5	5
3.05-4.05	10	3	4	3.7	7	3	6
4.05-6.05	-	-	9	0.6	2	0.94	5
6.05-9.05	-	-	-	-	7	0.06	2

The calculations of the theoretical distributions were performed by the Minsk-22 computer. The experimental and theoretical distributions of the measures of compactness are available in Table 15.

These data enable us to compare the experimental and the corresponding theoretical distributions of the measures of compactness. As regards the general experimental distribution, it

will be correlated with the theoretical distribution "b" since the average number of sentences in the total of protocols equals ten.

The comparison of the data available in Table 15 proves that in the intervals where the measure of compactness rates below 1.85, the relative frequency of the theoretical distribution exceeds greatly the relative frequency of the corresponding experimental distribution; and vice versa, with the measure of compactness greater than 1.85, the relative frequency of the experimental distribution exceeds the relative frequency of the corresponding theoretical distribution. This trend is less conspicuous in the comparison of the experimental distribution of group C and the corresponding theoretical distribution "c".

Table 16

The Generalized Characteristics of the Experimental and the Theoretical Distributions of the Measures of Compactness

	Distributions						General experimental
	Experimental for Group A	Theoretical "a"	Experimental for Group B	Theoretical "b"	Experimental for Group C	Theoretical "c"	
The average value of measure of compactness	2.05	1.85	2.35	1.80	2.30	1.86	2.24
The relative frequency of the measures of compactness greater than or equal to 1.85 (per cent)	50.5	27.5	53.0	33.7	49.0	37.0	51.0

Table 16 enables us to compare the generalized characteristics of the experimental and the theoretical distributions of the measures of compactness. The Table reveals, first, that the average values of the measures of compactness in case of the experimental distributions are higher than those in case of

the theoretical distributions; second, the relative frequency of the measures of compactness greater than or equal to 1.85 in case of the experimental distribution considerably exceeds that of the corresponding theoretical distributions. We would like to emphasize that with the data of the second line of the Table varying greatly in case of the theoretical distribution (27.5; 33.7; 37.0), the corresponding data pertaining to the experimental distribution show but little variance (50.5; 53.0; 49.0; 51.0). All this proves that the supposed psychological regularity which evokes preferences (manifesting themselves as explicit compactness) acts regardless of the quantitative characteristics of a protocol (the number of sentences it contains).

To what extent are the differences we have discovered between the experimental and the corresponding theoretical distribution essential to us? In order to answer this question we have to resort to the agreement criterion χ^2 which can be derived from the formula

$$\chi^2 = \sum_{m=1}^k \frac{(h_m - np_m)^2}{np_m}$$

where n is the number of protocols in a particular case, h_m is the number of protocols whose measure coincides with the m -interval, p_m is the relative frequency (probability) of the m -interval for the corresponding theoretical distribution.

In calculating χ^2 in individual cases certain adjoining intervals were combined to preserve the ratio $np_m \geq 5$ (256, 189). The results of these calculations, as well as all the necessary tabulated values are available in Table 17.

As is evident from Table 17, the distinctions between the three experimental and the corresponding theoretical distributions

Table 17

**The Reliability of the Distinctions Between
the Experimental and the Theoretical Distributions
of the Measures of Compactness**

Experimental and theoretical distributions	Degree of freedom	The estimated χ^2	$\chi^2_{0.001}$	$\chi^2_{0.002}$	$\chi^2_{0.1}$
for Group A and "a"	4	18.9	18.5		
for Group B and "b"	5	20.1	20.5	18.9	
for Group C and "c"	3	7.5	16.3	14.8	
General and "b"	6	54.7	22.5		6.3

are characterized by a very high degree of reliability. At the same time, the distinction between the experimental distribution for Group C and the theoretical distribution "c" may only take place when the level of significance amounts to 0.1, this distinction being insufficiently reliable.

Thus, the opposite hypothesis which seeks to ascertain the independent emergence of each construction is disproved for each case when a protocol contains less than 13 sentences. Thus it would be completely wrong to try to explain as accident the facts, revealed during the experiment, of explicit compactness available in the protocols containing less than 13 sentences. Yet, with the probability of 0.1, it would be possible to presume that the explicit compactness of the protocols containing from 13 to 15 sentences (Group C) was caused by accident. However, the share of protocols with explicit compactness is the same in Group C as in other groups (see Table 16); in other words, the insufficient authenticity of the distinction between the theoretical distribution "c" and its experimental counterpart is stipulated by an increase of the theoretical indices of compactness rather than by a decrease in the actual indices. Consequently, we have every reason to discard the possibility (even though it is highly improbable) of using accident as an explanation of the explicit compactness of the Group C protocols.

By excluding accident as a possible explanation of the established facts of preference (manifesting themselves in the compactness of a protocol), we have to admit that they result from a specific intrinsic psychological law the nature of which will be analyzed in detail after we have considered all the aspects of this experimental series.

Let us pass over to the second aspect of this series, and consider the relationship of the assigned words in the sentences composed by the subjects. We may propose *a priori* several ways of combining the assigned words. To begin with, we may presume that all the three assigned words together with the involved words may form a *one-component* sentence in which the assigned words either pose as homogeneous parts, or supplement one another. It is also possible that each assigned word belongs to a separate component of a *three-component* sentence. Finally, there is also the possibility of forming *two-component* sentences, with one of the components incorporating two of the assigned words, and the other, one. In this situation, we may expect the formation of three different variants of a two-component sentence: (1) one component incorporates two

of the assigned words, *A* and *B*, while the other, the word *C*; (2) one component incorporates the assigned words *A* and *C*, and the other, the word *B*; (3) one component incorporates the assigned words *B* and *C*, and the other, the word *A*. We have thus established five different ways of combining the assigned words in composed sentences: a one-component sentence, a three-component sentence, and three variants of two-component sentences. To support this, let us consider the conformable examples taken from the protocols (the assigned words being emphasized).

"*Knowledge* helped the heroes overcome all the difficulties of their *flight*, and return back *home*"* (a one-component sentence with grammatically conjugated assigned words).

"The people who have accomplished the first *flight* into space and broadened our *knowledge* about it enjoy world-wide respect; their photographs may be found in every *home*" (a two-component sentence with two of the assigned words, "flight" and "knowledge" included in one component, and the third assigned word, "home", in the other).

"The *knowledge* of optics helped me build a telescope which I used to watch the people in the *house* across the street prepare a *glider* for *flight*" (a three-component sentence, each assigned word included in a separate component).

The analysis of the protocols has revealed that *each* of the five ways of combining the assigned words was realized in handling *each* word-set; consequently, the ways proposed a priori appear to be practicable techniques for accomplishing the tasks. However, each concrete protocol was far from using all the possible ways. Table 18 shows the extent to which the subjects utilized the possible ways of combining the assigned words; it also provides the average number of sentences in the protocols corresponding to each number of the utilized ways.

As is evident from Table 18, all the five ways of combining the assigned words were used in a relatively small number of the protocols (18.5 per cent). Over 50 per cent of all the subjects utilized only three and less of the possible ways. At the same time, the tabulated data show a direct correspondence between the number of sentences in a protocol and the number of used ways: the more of them were used by the subjects for combining the assigned words, the more sentences they composed.

* The Russian word "dom" corresponds to the English words "house" and "home".—Tr.

Table 18

**The Utilization of Possible Ways of Combining
the Assigned Words**

Number of utilized ways	Frequency (expressed in per cent of the total number of protocols: 232)	The average number of composed sentences
5	18.5	11.9
4	29	9.9
3	27.5	7.3
2	21	5.7
1	4	3.2

Is there any dependence of the fulfilment of the instructions' quantitative requirements (to compose 15 sentences) on the utilization of all the possible ways of combining the assigned words? In order to answer this question, we have to verify the existence of the reliable correlation. For this, let us consider the four-marginal table of conjugation of the attributes—the presence in the protocol of 15 sentences and the utilization of all the five ways of combining the assigned words (Table 19).

Table 19

The number of utilized ways of combining the assigned words	The number of sentences in the protocol		Total
	15	less than 15	
5	14	29	43
Less than 5	7	182	189
Total	21	211	232

In calculating the agreement criterion χ^2 we took into account the Yates' correction for small marginal sums (256, 228-229): $\chi^2 = 32.0$. (The tabulated value of χ^2 0.001 = 10.83). Consequently, there is a highly reliable correlation between the fulfilment of a requirement of the instructions and the employment of all the possible ways of combining the assigned words in composed sentences.

The correlation we have thus established convincingly proves that the utilization of all the five possible ways of combining

the assigned words increases the opportunity of meeting the quantitative requirement of the instructions: to compose 15 sentences. However, since the overwhelming majority of the subjects (81.5 per cent) failed to use all of these methods, we may say that some methods were clearly *preferred*. Thus, prevailing in certain protocols were one-component sentences, while in others, three-component sentences made up by the subjects who worked with the same word-set. Even conceding that the subjects utilized all the five possible methods, they often showed preference for one and, rarely, two ways (see Tables 20 and 21).

Table 20

**The Frequency of Utilizing Different Ways
of Combining the Assigned Words
(Word-Set II)**

Ways of combination	The number of cases in protocols
One-component sentence	6 1 1 3 6 6 4 2 3 3 5 2 6 8 5 3 3 6 3 9 3 5 1 7 3 2 4
Two-component sentences	
an apple, a room	5 0 1 0 1 0 0 1 1 2 2 1 0 1 0 0 2 2 0 1 1 0 1 9 2 0 2
an apple, an armchair	3 1 2 4 1 1 0 4 0 0 0 3 2 3 2 2 6 0 2 0 1 1 0 1 1 2 1
a room, an armchair	5 0 2 7 1 4 0 6 2 2 1 3 4 1 4 7 0 1 1 0 4 1 2 2 6 3 6
Three-component sentence	1 1 2 4 6 0 5 0 3 1 0 3 0 0 0 1 0 0 2 1 1 0 1 1 3 2 3

We would like to emphasize that one and the same way of combining the assigned words admits different logico-grammatical character of their combination. For example, in a two-component phrase, two assigned words may either supplement each other assuming different grammatical functions or be "on a par" grammatically. In the first case, we may discuss a *conjugation* of two assigned words, for example, "a new *city* has grown among the *fields*"; in the second case, their *co-subordination*, for example, "a plane was flying above the *field* and the *city*". Co-subordination may also be indirect when two assigned words are subordinate to other homogeneous words, for example, "cavalry was pushing on trampling down *fields* and devastating *cities*".

Table 21

**The Frequency of Utilizing Different Methods
of Combining the Assigned Words
(Word-Set X)**

Methods of combination	The number of cases in protocols
One-component sentence	1 2 1 4 5 0 5 1 1 0 3 8 5 1 5 1 0 5 6 2
Two-component sentences	an argument, evening
	0 0 0 1 3 3 3 2 2 1 0 0 10 1 7 2 2 0 3
	an argument, a store
	2 0 0 0 0 1 0 2 0 1 0 0 1 1 0 1 0 1 0 0
	evening, a store
	0 9 1 0 3 2 1 3 4 9 0 4 2 4 0 1 1 6 0
Three-component sentence	1 0 0 0 1 0 1 5 3 1 0 0 1 0 0 0 0 0 0 0

The variants of combining two assigned words (conjugation and co-subordination) are used with varying frequency by different subjects working with the same word-set. Table 22 shows the comparative frequency with which these variants are utilized by a subject.

Table 22

**The Frequency of Two Variants of Combining
the Assigned Words "FIELD" and "CITY"
(Word-Set VI)**

Variants of combination	Number of cases in protocols
Conjugation	2 1 2 1 0 0 1 0 2 1 0 4 1 0 1 1 0 1 3 0 3 0 0 1 1
Co-subordination	5 0 6 1 3 1 0 1 0 1 0 0 0 0 0 1 0 0 0 1 1 0 1 0 1

As is evident from Table 22, even though our analysis of a problem was limited to an extremely narrow aspect (logico-grammatical character of organization of words into a two-component combination), a number of protocols reveal the subjects' preference of one or another ways. In 14 protocols (out of 25), the assigned word-set, "a field—a city", is either omitted completely or is used only once, which makes these protocols irrelevant for our analysis. Four protocols contain

one case of conjugation and co-subordination each; and we find it possible to regard these data as the facts of the uniform utilization of two possible ways. Finally, 7 protocols (comprising 64 per cent of all the cases under consideration) reveal a pronounced tendency for preferences, the balance tilting four times toward conjugation, and three times toward co-subordination.

The sentences in which the subjects utilize the same ways of combining the assigned words are often arranged in a row: for example, at the beginning of a protocol there may be a series of one-component sentences followed by a series of three-component sentences. This creates the impression that no sooner does a subject strike upon a new construction than he would resort to his find throughout the considerable portion of the subsequent sentences in the protocol.

To sum up, we can assert that in the bulk of the protocols the subjects only utilized a few of the possible ways of combining the assigned words just as they tended to biased utilization of logico-grammatical variants in organizing the assigned words; in other words, the protocols reveal a pronounced tendency to give preference to certain ways while fulfilling a task.

Next, we would like to consider the involved words. The analysis of these words has to be selective, since it would be impossible to embrace and classify all the words used by the subjects for composing their sentences. We would like to dwell on two groups of involved words. The first group includes the words posing as grammatical subjects in the composed sentences (and we refer to them conventionally as active). The second group includes verbs and verbal forms, as well as various auxiliary words which serve to connect the assigned words. For example, such assigned words as "a field" and "a city" were often surrounded by the prepositions "through", "across", "behind", "in", etc. We attach special importance to these two groups, since no sentence would be possible without them; hereafter they will be referred to as the main involved words. As to the other involved words, they too have to convey certain semantic and aesthetic functions, yet the instructions do not necessitate their presence in the sentence.

Since the instructions offer the subjects unlimited opportunities for expressing any idea without confining him to any particular form, it would be logical to presume that the subjects may resort to a great variety of concepts utilizing multitudes of words for expressing them. The results of our experiments, however, do not support this promise. And in studying

the conceptual aspect of the sentences we arrived at the conclusion that in the majority of cases subjects failed to realize these opportunities.

In the article containing the results of this experimental series (79, 56-57), we had indicated that at least one-fifth of the main involved words (subjects and verbal predicates) comprised the words which had been earlier utilized in the same protocols. The share of the recurring main involved words was determined by our computing the mean arithmetic value in each set of the assigned words. At the same time, we can obtain a more differentiated picture of the facts of preferences of the main involved words if we consider the distributions of the percentage of the recurring main involved words with respect to all the main involved words in each protocol. The data pertaining to these distributions are available in Table 23 (in determining the number of the involved words we, naturally, did not take into account their first usage in the protocol, which is to say that the recurring words are "non-original" in the particular protocol).

Table 23

The Recurrence of the Main Involved Words

The percentage ratio of "non-original" words against the total number of the main involved words in the protocol (limits of intervals)	Relative frequency (per cent of the total number of protocols—232)	
	Active involved words	Verbs and some link-words
0	26.5	7.5
0.01—9.99	0.5	3.0
9.99—19.99	11.5	21.0
19.99—29.99	19.0	33.5
29.99—39.99	10.0	25.0
39.99—49.99	11.0	6.0
49.99—59.99	11.5	3.0
59.99 — and more	10.0	1.0

Table 23 proves that at least in one-fifth of all the composed sentences almost 60 per cent of the tested students used grammatical subjects they had utilized earlier, and nearly 70 per cent repeated verbs and auxiliary words needed to link the assigned words. The few cases when the involved active words (grammatical subjects) were not used more than once (26.5 per cent of the tested students) can be explained by

the fact that the students used the assigned words as grammatical subjects. Besides, we took into account only the cases of literal coincidences, while quite a few sentences featured synonyms of the earlier utilized words and other synonymous expressions. If we had also taken into account all these cases, the percentage of the recurring words would have been higher.

Thus, in considering the involved words we established the subjects' tendency to repeat time and time again the earlier utilized words, semantically different sets of the assigned words revealing rather close values of recurrence percentage (see also 79, 56-57). Owing to the fact that our experiment offers practically unlimited opportunities for involving new words, we may, quite reasonably, affirm the subjects' preferences for such words.

Consequently, in all aspects of the examined experimental acts we observed a highly essential general peculiarity which may be described as follows. A subject, once he has found a way which enables him to organize or group the assigned words with one another and with other words, is inclined to utilize his find continuously without even looking for any new finds, as though showing reluctance to give up what has proven adequate. This tendency for the fullest possible utilization of a particular find manifests itself, first and foremost, in the high degree of compactness of sentences with an identical construction in protocols; in the subjects' preference of specific variants of logico-grammatical organization of words; and, finally, in their preference for concrete involved words. In addition to the general phenomena we have mentioned, which occurred in almost all protocols, we also may come across even more specific cases of multiple usage of one and the same find. These facts are also traceable in a great number of protocols. However, they are very diverse, which makes it extremely difficult to summarize them statistically. We will describe them in general terms.

One of the peculiarities of the composed sentences is that they may have two semantic *planes*: external and internal. The utterance contained in the external plane serves, as it were, as an envelope of the utterance contained in the internal plane. Thus in the sentence "He read a lot of *books* which dealt with *stars*, planets and *clouds*", the principal clause forms the external plane, while the subordinate clause, the internal. We observed the two-plane construction most frequently in analyzing sentences composed on the basis of word-sets I and VII because the very assigned words, "a book" and "a telegram",

suggest such a possibility ("the book described...", "the telegram read..."). Yet, in the sentences composed on the basis of other sets, the two-plane construction is utilized rarely; at the same time, should the subject "strike upon" it, he would never restrict himself to a single two-plane sentence. For example, in one of the protocols (II), two sentences (7 and 8) are composed as two-plane constructions: 7. "In discussing the interior of the *room*, they decided to buy an *armchair* and to hang on the wall a picture in which an artist painted *apples*" (the assigned word "apple" being on the internal plane); 8. "...entered the *room*, and sat in *armchair* indulging in the prospects of having fresh *apples* for dinner" (the word "apple" again appearing on the internal plane).

We find somewhat unusual the structural discovery of the so-called *unification* of the assigned words when they appear as homogeneous parts of the sentence. No sooner has the subjects discovered a possibility of unification than they resorted to it in several sentences, such as "*Keys* and *earrings* and even a maiden's *smile*—all of these items were on sale here"; "*Pupils* were given the words: *key*, *earrings*, *smile* for composing a sentence out of them."

We also qualified as a find metaphorical usages of an assigned word or its usage as a comparison. Our subjects resorted to this way quite a number of times. Thus, in one of the protocols (IV) the fifth sentence contained the expression "the *key* to /one's/ heart", and the sixth phrase, the expression "the *earrings** of birches". In another protocol (the same word-set) the fourth sentence includes "the *catkins* of birches", while the next sentence has "the beauty parlor *SMILE*". In one more protocol (VIII) we read: "...his teeth, just as small *nuts*" (sentence 7) and "...the bay was shining like a *mirror*..." (sentence 8). It is noteworthy that the discovered way of unusual usage of the assigned words is applied to different words.

There are also some cases when the subjects sought to add the final touch to their phrases by introducing "additional" simple sentences which served the goal of logically tying in separate components of the whole even though they did not include any assigned words. We observed the usage of such additional sentences several times in a row in one of the protocols (II): sentence 8: "Joy filled the whole house...";

* The Russian words "ser'ga" ("an earring") and "seryozhka" ("a catkin") have the same root. —Tr.

sentence 9: "Was he really much surprised when..."; sentence 10: "She liked the noisy streets of the city...". Although none of these additional sentences contains the assigned words they helped the subject to easily combine the assigned words into a harmonious sentence.

In a number of protocols we observed multiple usages of one and the same syntactic form (say, an impersonal or an indefinite personal sentence), the same conjunctions for connecting clauses, etc.

The facts we have exposed supplement and somewhat clarify our basic premises asserting that all the finds, no matter their significance, one way or another serve to direct and determine the subjects' searches, adding to their sense of preference. Yet, although we have to admit that these preferences are certainly not as stable as those which we discussed above (see Tables 15 through 23), they nonetheless undoubtedly influence the results of the activity under study.

Therefore, the totality and diversity of the materials we have collected prompts the conclusion that in the course of his productive activity the subject normally gives preference to a particular way of fulfilling his assignment. Presumably, we are dealing here with an essential internal psychological peculiarity which is stipulated neither by the instructions nor by the character of the experimental material nor the subjects' experience.

We could see that the instructions in no way restricted the subjects' "play of phantasy". In reality, however, they were not realizing their opportunities in full. We are not discussing here only purely theoretically conceivable variants the number of which is, essentially, immeasurable in some respect, (e.g. in the utilization of involved words). What we really have in mind are the variants, observed throughout the experiment, which were practically chosen by the subjects.

One would object that there is no need to resort to any new ways (such as the employment of a great number of ways of combining either the assigned words or the new involved words) as long as we can rely on the ways which have already been used. Yet, what really matters is the fact that the ways which were actually used in individual protocols were not quite adequate, since one of the requirements of the instructions was not met: only a limited number of our subjects managed to compose all the fifteen sentences, while in the overwhelming majority of the protocols the number of sentences varied between six and eleven. If all of our

subjects had widened the range of their ways, they would have easily met the quantitative requirement of the instructions.

The limited employment of the ways of fulfilment may not be ascribed to the primary material either (the assigned words), since on the whole we have come across a great variety of forms resorted to by the subjects in composing their sentences. This means that the material in itself did not impose any restrictions on the subjects, but, on the contrary, it offered them enormous opportunities.

There is no doubt that a number of circumstances preceding the heuristic situation have to encourage a certain way of thinking, which simultaneously obstructs the progress of thought in another direction; however, the reliance on the factors which were effective in the past masks the peculiarities of *actual* activity. As we have already observed, extremely great significance is attributed to the preceding factors in the hypotheses of archetypes and functional fixedness which we analyzed in Chapter II (the correlation of the functional fixedness with our conception will be shown in Chapter V); these hypotheses almost fully annul the role of actual factors effective at the moment of accomplishing productive acts.

This experimental series in particular clearly revealed the facts which could not be explained exclusively by the influence of past experience; it is true that, in considering the first aspect (the compactness of the protocols), we established the dynamic nature of preferences manifesting itself in alternations of the compactly grouped active and passive constructions, while in considering the second (ways, modes of combining the assigned words) and the third (recurrence of the involved words) aspects we ascertained the tendency of some of the modes, ways, to prevail over the others. The facts of preferences which we have described may not be regarded merely as a result of previous or external influences, inertness of thinking, rigid fixedness, sets, etc. Contrary to that, the totality and diversity of preferences result from the *very* productive activity and are caused, we may presume, by an internal psychological mechanism which operates as follows: a successful find (objectively or subjectively successful) acquires *increased value* which leads to the devaluation of all the other ways of fulfilling a task. We have designated the hypothetical mechanism by the term *hyperaxiomatization* (Greek, the prefix "hyper", "over", and the root "axio", "evaluate"). We view the mechanism of hyperaxiomatization as an objective psychological law stipu-

lating a stabilizing effect, such as the expressed compactness of the protocols or the limitation of the number of ways of fulfilling a task. However, in the same way as anaxiomatization, hyperaxiomatization is not confined exclusively to the negative phenomena we described above. The stabilizing effect of the hyperaxiomatization has obviously found its expression in the phenomenon which heuristic literature has defined as "reduction of the search area" and "decrease of the number of variants". Consequently, hyperaxiomatization has to play a definite positive role in creativity since it makes it no longer necessary to scan all the available variants by raising the value of some of them while simultaneously devaluating the others. In the Chapters that follow we will analyze the data obtained by various authors and consider other negative and positive effects of the mechanism of hyperaxiomatization.

THE FOURTH EXPERIMENTAL SERIES

The results of the previous experimental series presuppose the existence of two internal mechanisms of phantasy which we termed "anaxiomatization" and "hyperaxiomatization". This compels us to determine the relationship between them.

Presumably, they are two independent mechanisms which somehow interact with or influence each other. However, one may presume that their interconnection and interdependence is essentially much closer, and indeed in conducting our experiments which enabled us to discover the mechanism of hyperaxiomatization we could quite clearly observe, for instance, that increased evaluation of one of the ways of combining the assigned words in a sentence automatically devaluated other ways. Would it be right to assert that this dependence is also characteristic of the opposite case, i.e., that anaxiomatization leads to hyperaxiomatization? In order to answer this question the subjects involved in our experiment were instructed to solve problems which presupposed the devaluation of a certain portion of information they were provided with. Thus we could observe the operation of the mechanism of increased evaluation which was in no way required by the instructions.

The successful accomplishment of this experiment necessitates the employment of material which may enable us to give a concrete quantitative characteristic to the phenomena of hyperaxiomatization. Just as in the previous experiments, we relied mostly on semantic material. Our subjects were 82 students of two 9th and one 10th forms of Minsk. The subjects

were instructed to make a written concise rendition of newspaper articles of 300, 310, 340, 570 and 700 words, with the abridgements of the texts having been performed twice: short articles (300, 310 and 340 words) were, at first, reduced to 100 words, and longer articles (570 and 700 words), to 150 words (we will term the results of this assignment as "Variant I"); thereafter the texts were reduced, respectively, to 50 and 75 words (Variant II). Throughout the whole experiment the subjects had the original texts at their disposal (a newspaper clipping), and in the period of secondary abridgement they could also use their own Variant I.

The instructions emphasized that any form of fulfilling a task would be acceptable provided the basic content of the article was preserved.

The students involved in the experiment were fulfilling the task conscientiously and showing interest in it. All the basic requirements of the instructions were observed except in two cases (they were not taken into account during the analysis of the experimental material); however, the number of words in both variants varied greatly. In order to clarify the problem we were concerned with, we attached primary importance to a comparison of variants since, in making the secondary abridgement, the subjects had to devalue a certain portion of the material which had been compiled by them from beginning to end. Consequently, the omissions available in Variant II may not be explained by the subjects' radical reinterpretation of the text, nor by their inadequate attention nor misunderstanding, in other words it fully complied with the instructions to devalue half of the material.

What were the varieties of sentences in Variant II? We included these data in Table 24.

Table 24
Varieties of Sentences in Variant II

Varieties of sentences	Per cent of the total number of sentences (853)
Sentences with unchanged volume	38.0
Abridged sentences	16.5
Reconstructed and new sentences	33.5
Reminiscence sentences	12.0

We termed as "new sentences" those which represent either a fusion and transformation of several sentences of Variant I or the expression by the subjects of their own opinions and their attitude toward the content of the rendered material. The term "reminiscence sentences" denotes the sentences which are available in the original (newspaper) texts, but were not included in Variant I; in some cases, they were slightly modified.

These data indicate that the same quantity of words as in Variant I *was preserved* in a considerable number of sentences (38 per cent), in spite of the requirement to abridge the text. The abridged sentences comprise only 16.5 per cent, including those in which not more than one or two words were missing. However, as long as Variant II was always shorter than Variant I we may conclude that in order to abridge the text the subjects often discarded a considerable number of *whole* sentences. Table 25 shows the number of sentences completely discarded during the secondary abridgement.

Table 25
**The Average Number of Discarded Sentences
 in the Texts**

Texts	The average discarded sentences, as percentage of the total number of sentences in Variant I
1	42
2	49
3	57
4	35
5	40

As is evident from Table 25, the number of discarded sentences varies depending on the text.

Therefore, in making the secondary abridgement of the texts, the subjects often anaxiomatized its major units—sentences, the degree of anaxiomatization depending on the character of the text. How does hyperaxiomatization, the second hypothetical internal mechanism, manifest itself in this situation? We may presume that the devaluation of sentences may lead to increased evaluation of the other elements of the text—words, which are preserved even though they *may* be omitted from the standpoint of logic and grammar and *should* be omitted if we follow

the requirements of the instructions. Provided such a dependence exists, it has to produce the following quantitative effect.

Let us designate the number of words in Variant I by the letter A , the number of words in Variant II, by the letter B , and the number of words which were included in the sentences present in Variant I and absent from Variant II, by the letter C . The difference between the value $A-B$ and the value C will be negligible if the subjects perform the abridgement of their text by discarding whole sentences. Conversely, if they abridged the texts by "deleting" individual words from the sentences (naturally, in this process whole sentences might also be discarded), the difference between the values $A-B$ and C will be statistically reliable.

As we have already noted, alongside the abridged and fully preserved sentences Variant II also contains new sentences and reminiscence sentences. In computing the words using the above methods, these sentences were not taken into account in the same way as their counterparts in Variant I which served as the primary material for new sentences. In order to obtain comparable data throughout the protocols we did not juxtapose directly the values $A-B$ and C , but their percentages with respect to the value A .

For making comparisons of these two values: $\frac{A-B}{A} \times 100$ and $\frac{C}{A} \times 100$ we employed a formula which enabled us to establish the reliable difference of totalities with coupled values:

$$t\Delta = \frac{\Delta \times \sqrt{n}}{\sigma},$$

where Δ is the mean difference of the compared values (and the difference of the mean values), n is the volume of the selected material, σ is the standard deviation.

Table 26 offers the comparison data of the number of words in the comparable sentences of Variant I and Variant II.

Table 26 shows that the abridgement of Texts 1, 2 and 3 produced the following effect: there were almost no cases of deletions of words from preserved sentences, thus there was no statistically reliable difference between the values $A-B$ and C . At the same time, there was a marked difference between these values revealed in the abridgements of Text 4, which means that the subjects were fulfilling the instructions also by "deleting" individual words from the remaining sentences. Finally, the difference between the comparable values is less pronounced in the abridgement of Text 5.

What is the explanation of such widely varying results? The anticipated effect of the increased evaluation of words which manifests itself in their special stability in the preserved sentences is the logical outcome of the hypothesis according to which the hyperaxiomatization of certain elements of the text (in this case, the words) is caused by the anaxiomatization of other elements (the sentences). It would be natural to presume that this effect takes place with more pronounced anaxiomatization of the sentences. Table 25 reveals that in abridging Texts 1, 2 and 3 (the first group) the subjects discarded more sentences than in abridging Texts 4 and 5 (the second group). In order to clearly establish the essential difference between the quantities of the discarded sentences while abridging the texts of both the first and the second

Table 26
**The Comparison of the Number of Words in Comparable Sentences
of Variant I and Variant II**

Texts	<i>n</i>	Σ	σ	t_3	$t_{0.05}$	$t_{0.01}$
1	9	1.9	6.5	0.87	2.31	3.36
2	15	0.3	4.35	0.27	2.15	2.98
3	5	-1.8	3.5	-1.18	2.78	4.60
4	16	5.3	6.3	3.36	2.13	2.95
5	15	2.8	4.3	2.52	2.15	2.98

Note: the Table does not reflect the protocols with prevailing new sentences and reminiscence sentences, i.e., the protocols with only 10-30 per cent of comparable sentences.

groups, we resorted to Wilcoxon's criterion (Mann-Whitney-U test) which enables us to prove or disprove a hypothesis attributing two selections of materials to one and the same general totality (universe) (88, 281-283). We applied Wilcoxon's criterion to prove that the data presented in Table 26 concerning the first and the second groups are data pertaining to various general totalities, i.e., the number of sentences discarded from the protocols of the first group is much greater than that of the second group (by discussing the number of sentences in Variant II we mean their percentage of the number of sentences in Variant I).

The utilization of the criterion presupposes in the first

place the computation of inversions,* their number $U = 288$.

The mathematical distribution of inversions is determined according to the formula $M_u = \frac{mn}{2}$, where m and n are the values of selections.

In our particular case, $M_u = \frac{29 \times 31}{2} = 449.5$.

The dispersion is determined according to the formula

$$\sigma_u = \sqrt{\frac{mn}{12} (m + n + 1)}.$$

In our particular case, $\sigma_u = 67.7$; t equals 1.96, with the significance level of 0.05.

The critical sphere of values (the coincidence of U with this sphere indicating the difference of selections) lies within the following limits:

$$U \leq 449.5 - 1.96 \times 67.7 \approx 317$$

$$U \geq 449.5 + 1.96 \times 67.6 \approx 582$$

The value of inversions, $U = 288$, which we have thus obtained, coincides with the critical sphere. This means that, in abridging the texts of the first group the subjects discarded essentially more sentences than in abridging the texts of the second group. In more accurate terms, the anaxiomatization of sentences is expressed stronger in the protocols of the first group than in the protocols of the second group. This difference may be preconditioned by the character (the content and the form of rendition) of the original text, as well as a subject's emotional attitude toward it. Yet, irrespective of the reasons producing a more intensive anaxiomatization of sentences, our data prove that it effects the hyperaxiomatization of the other elements of the text, i.e., the words in the remaining sentences. This finds its expression in the unquestionably greater stability of words and in their preservation under the conditions when the subjects are instructed to abridge the

* In contrast to our earlier methods of processing the results (75, 135-136), in this experiment we based our analysis on the quantity of discarded sentences (rather than the remaining sentences as in the article we have referred to). Whenever certain data coincide in both comparable groups (which precludes accurate computation of inversions), we achieved the difference by deliberately augmenting the data pertaining to the second group. Since our purpose was to prove that the data pertaining to the second group have a lower value than those of the first group, this augmentation only adds to the veracity of the proof.

text, the yardstick of the successful fulfilment of the task being the number of words rather than of sentences.

However, this may give rise to the objection that the absence of the facts of deleting words from sentences could merely be interpreted as the result of the subjects' fulfilling their task by discarding sentences, owing to which there would be no special need to delete words from the sentences remaining in Variant II. This objection would certainly hold if the subjects had been strictly fulfilling one of the main demands of the instructions: not to exceed the number of words established for Variant II. Our data, however, prove that in the first group of texts this requirement was met only in 34 per cent of all the experimental cases, including those when Variant II featured a slight excess of the number of words (3-5), in compliance with the instructions; in the second group this requirement was met in 52 per cent of all the experimental cases. These facts suggest that it would be erroneous to presume that to meet the instructions' demands, one would merely have to discard a certain number of sentences; on the contrary, it would be advisable to delete a certain number of words from the remaining sentences, and in doing so one could easily observe the style and grammar and preserve the meaning of the text. This explains the assumption that the fulfilment of the instructions is obstructed by the increased evaluation of words in the remaining sentences.

Thus, these considerations also serve to support the premise that we are dealing with the hyperaxiomatization of words, as elements of the text, resulting from the anaxiomatization of sentences as other units of the text.

Finally, this experimental series provides us with proofs that the mechanisms of anaxiomatization and hyperaxiomatization revealed earlier in various investigations are associated through a deeper two-way internal dependence: it is not only that an increased evaluation of a certain mode of fulfilling a task leads to the devaluation of other methods (this dependence is implied in a purely logical way), but, vice versa, the devaluation of certain aspects and moments in the course of mental activity entails the increased evaluation of other aspects and moments. It goes without saying that we may trace this subtle effect and, which is most important, assure its reliability only in case of sufficiently pronounced anaxiomatization. Obviously, the intensive manifestation of one of the hypothetical mechanisms of phantasy entails respective intensification of another mechanism, which reveals their interdependence and unity.

SUMMARY

In order to reveal some internal laws of phantasy, we made experimental study of various types of productive activity, such as attempts at solving unsolvable problems, organizing words into groups, making up sentences with the employment of assigned words, and, finally, abridging a text.

The results of our four experimental series and the theoretical conclusions made on their basis were published in the Soviet Union (70; 73; 74; 75; 79). Our further profound analysis of the experimental results caused us to realize the need to improve the factual basis of our theoretical conception. In one instance, it was sufficient to slightly modify and improve the methods of presenting factual materials (the fourth experimental series), in another, it was required to use more differentiated statistical methods for processing experimental data (the third experimental series), while in the third instance it was necessary to radically change the whole structure of the experimental material, and thus to accomplish new experiments (the second experimental series). Additional researches and application of refined mathematical methods in no way disproved the authenticity of earlier theoretical postulates, but, on the contrary, enhanced their exactness, correctness and veracity.

The reliability of the results of our experiments is supported by numerous data obtained by other investigators from didactic (17) and criminalistic (86) materials.

The experimental data enabled us to establish a number of characteristic facts, to designate which we used special *descriptive* concepts: illusory solution, omission of limiting features, neglect of distinctions, broadening of relationship, upturned relationship, partial observance of the assigned relationship, compromise illusory solution (the first experimental series), alien elements in groups and subgroups, extraordinary grouping, uni- and multi-type organization of words (the second experimental series); pronounced compactness of a protocol, preference, utilization of non-original words (the third experimental series); discarding and deletion of elements, increased stability of words (the fourth experimental series). However, the theoretical interpretation of the observed facts involved only two *explanatory* concepts: an axiomatization and hyperaxiomatization, denoting two hypothetical fundamental internal mechanisms of phantasy. The first mechanism, characterized by non-predetermined orientation, devalues this or that information or one or another mode of mental activity, while the second mechanism

brings about an increased evaluation of a successful, from the subject's point of view, way of fulfilling activity, as well as an increased evaluation of this or that information. Both cases reveal shift of evaluation of certain psychic realities.* The available facts show that both hypothetical mechanisms of phantasy are closely interdependent and are an expression of a deeper general law.

In this connection it would be quite natural to pose the problem of the relationship between the traditional concepts and the explanatory concepts we have proposed. It would be of interest to establish whether they reflect one and the same, but designated in different ways, internal psychic reality or its various aspects. It would also be of interest to determine which of these explanatory concepts—traditional or proposed ones—are more general.

From the standpoint of the hypothetical laws of phantasy we find it possible to interpret both analysis and synthesis (which served as explanatory concepts in other views) as products of the mechanism of anaxiomatization: a devaluation of deep-rooted links leads to the dispersion and disintegration (analysis), while a devaluation of the existing differentiations preconditions the appearance of proximity and unification of separate data (synthesis, as well as recombination). Meanwhile we have to admit that on the face of it this interpretation appears to be a simple replacement of one term by other. However, it is also possible to more rigorously verify the applicability of our conception to various productive activity, as long as it is suggestive of such an essential effect as hyperaxiomatization. In more concrete terms, our conception of phantasy may be defined as adequate only when we have proved that the two hypothetical mechanisms can be discovered in various phenomena of creativity.

* Our investigation was focused only on the psychological mechanism affecting one way or another subjective evaluations of the present information. As to the nature and origin of the subject's attitude toward the received information, for the standpoint of its value, these problems have acquired special importance for a number of sciences including epistemology, aesthetics, ethics, linguistics, etc.

Chapter V

INNER PSYCHOLOGICAL MECHANISMS OF PHANTASY AND THEIR CONTRIBUTION TO VARIOUS PRODUCTIVE ACTIVITIES

GENERAL OUTLINE OF THE PROPOSED THEORY

According to the proposed theory of phantasy whatever the nature and consequences of productive activity, there is always shifting of evaluations in that, on the one hand, some information, modes of task performance, and techniques of its performance are devalued (the anaxiomatization mechanism) and, on the other hand, the results obtained and the methods used are given an increased evaluation (the hyperaxiomatization mechanism). The two mechanisms are not merely interrelated; they seem to embody a more profound unique law.

A theoretical analysis of the existing theories of productive activity (Chapter II) has led to the formulation of, in our view, significant requirements which must be satisfied by any hypothesis which claims to explain the phenomena of phantasy. Such hypotheses should take into account such features (principles) of phantasy as the dependence of its products upon reality, its activeness, its "assessability" (the subject's evaluative relation to the material of phantasy), and non-predetermination (unpredictability) (the ability of phantasy to create something essentially new). Let us see how these requirements are met by the existing theories of productive, or creative, activities.

The relationship of phantasy products to reality is expressed in the most straightforward way in theories which reduce this process to imitation either of external reality (the recombination and analogy theories) or of the contents of the inner world (the theories of subconscious imagination and archetypes). But the idea of imitation is, in its essence, incompatible with the idea of the possible creation of the fundamentally new.

The principle of active mental processes underlies theories which explain facts in terms of self-regulation, set, and purposeful actions such as analysis and synthesis. The value of these theories is in that the explanatory concepts they rely on are viewed as inner laws. These theories, however, cover

only positive facts, and are incapable of explaining negative facts.

The evaluation principle is incorporated in certain concepts of staged processes in which evaluation constitutes a particular, usually final, stage. In fact, however, assessment is practiced at different stages of creative processes, as well as at that stage where a solution has been found. Consequently, the evaluation principle needs a more extensive treatment in any theory of phantasy.

As for non-predetermination (unpredictability), the significance of which has not been appreciated until relatively recently, it is present, strange as this may seem, in the earliest theories of phantasy, albeit in a simplified form. This is the case with the serendipity and trial-and-error theories, where the principle of non-predetermination (unpredictability) is, as it were, projected outside because all creative accomplishments are treated as external lucky occurrences.

Consequently, traditional theories of productive activities represent all the principles of phantasy more or less explicitly and comprehensively, albeit separately; this suggests that reality itself has led the investigators to use, albeit not purposefully, the fundamental principles of phantasy in their theoretical constructions.

The proposed theory seems to incorporate all the above principles organically. Above all, the material which is processed by the both inner mechanisms is regarded as taken from the real, objectively existing world. It is data which, directly or indirectly, reflect objects, phenomena, and their properties, existing independently of the mind, that are devalued and overvalued. Consequently, reproduction is a major prerequisite of productive activity; the probabilistic nature of reproduction (59; 76) ensures a variety of responses and ways of performing the task.* Furthermore, our theory expresses sufficiently explicitly the principles of evaluation and activeness, since productive activity is regarded as active shifting of evaluations.

Finally, in treating the findings of the second experimental series (Chapter IV) an axiomatization has been noted to be unpredictable (non-predetermined) as far as its direction is concerned; therefore, unlike the serendipity and the trial-and-error theories, in our theory the unpredictability of phantasy

* In effect, the proposed theory is contiguous with our earlier concept of recollection.

is explained by an immanent property of one of its inner mechanisms rather than by accidental, external events.

In this Chapter we will try to see whether the proposed theory of phantasy is indeed applicable to the various manifestations of productive activity which have been studied by psychologists and other researchers in the humanities. We are well aware of the fact, however, that a comprehensive and exhaustive explanation of the phenomena of creativity would also require that we draw upon other laws formulated in the philosophic sciences (such as the theory of knowledge, logic, and aesthetics), and in art studies and such specialized disciplines as the theory of painting, the theory of music, the theory of literature, etc., as well as in psychology.

**EXPERIMENTAL DATA REPORTED
BY OTHER AUTHORS AND CONFIRMING
THE PROPOSED THEORY OF PHANTASY**

As a rule, researchers devote almost all of their efforts to investigating facts which seem to corroborate their theories, while data that could be interpreted differently are either overlooked or given but a modest space in describing the experimental results. Nevertheless, as we will try to show, a careful analysis of traditional and, even more so, modern research into productive activity reveals facts that match with our data and are explicable in the framework of the proposed theory.

Let us start with certain characteristic facts that were described by Watt of the Würzburg school.

Referring to his experimental facts, Watt says that the search for a generic concept is easier than the search for a species concept, because the former takes less time. This result is explained by suggestion that in real life tasks involving the selection of species concepts are rarer than those involving the selection of generic concepts. The same investigation noted, however, that species concepts were replaced by synonyms (or equivalent concepts) or even by rather remote notions. Should this phenomenon be explained by a more often occurrence of synonyms than of species concepts in real life? Watt offers no answer.

About twenty-five years later Albert Burloud re-examined Watt's conclusions and noted, in particular, that incorrect responses can be traced to neglect for the set task. Further, he showed that this neglect is not attributable to incomprehension.

of the task by the subject, and that the task to point out a species concept is not more difficult than that to point out a generic concept. He explained the errors by arguing that movement towards the species is less natural, less habitual than towards the genus because the latter occurs more often.

Both Watt and Burloud came across a significant fact, indicated its most essential psychological feature ("neglect for the task"), and were on the verge of seeing the general law behind the fact, but overlooked this law because they tried to squeeze the fact into a ready-made theory. We believe that the experimental fact as described by Watt and Burloud is quite compatible with the data of our first experimental series (see Chapter IV) and is naturally explainable by the anaxiomatization mechanism. Watt's subjects, who found it difficult to tackle the task, devalued some of its requirements and constraints and this replaced it with a more general task. More specifically, in compliance with the new task which was engendered by anaxiomatization, they adduced generic concepts, synonyms, etc. as well as species concepts.

Our explanation of the fact reported by Watt requires no additional and arbitrary assumptions that the subjects have dealt with one variety of logical relations more often than with others, or that a generic concept is easier to specify than a species concept. In short, the anaxiomatization mechanism seems to provide an adequate interpretation of an interesting and informative fact.

The experimental data being gathered by researchers today provide numerous facts that seem attributable to hyperaxiomatization. This is true of the incubation phenomenon described in Chapter II, where attempts to explain it were analyzed.

The "stagnation of thinking", characteristic of this stage, can, in our view, be interpreted as an effect of the hyperaxiomatization mechanism, which significantly reduces the number of options. To put it differently, the increased evaluation of some options in the early stages prevents others from being seen. In time, however, the increased evaluation is weakened and other options become conspicuous, including the correct answer. This explanation of the "incubation phenomenon" requires no hypothetical assumptions concerning a subconscious search for options or a change in the set purely as a result of the passage of time. The assumption that an increased evaluation may weaken with time is consistent with an understanding of hyperaxiomatization as a dynamic law, different, say, from "functional fixedness" of Dunker.

Interesting facts which are evidence of the reality of the hyperaxiomatization mechanism are reported in recent investigations where the anagram technique was employed. In several series of carefully designed experiments Mayzner and Tresselt studied conditions necessary for a successful solution of anagrams. They noted that widely-used words were easier to guess and that words were formed more quickly from meaningless combinations of letters.

Their data also clearly show that the re-arrangement of one meaningful word into others is much more difficult than constructing this word from the same set of letters presented in a "meaningless" combination. Mayzner and Tresselt themselves overlooked this fact which we have established on the basis of their experimental data, and consequently offered no theoretical explanation. In our view, the facts can be explained as follows. The assigned word, though serving, according to the instructions, only as a stimulus or initial material for forming another word, is also a possible solution because, first, it includes all the assigned letters and, second, has a sense (i.e. two requirements of the instructions are met). Since, with some weakening of the requirements, the assigned word can also be viewed as a solution, it acquires an increased evaluation which makes it difficult for the subject to see alternatives. On the other hand, a meaningless set of letters cannot be regarded as a solution by the subject, because it does not meet a major requirement, i.e. that the resultant words should make sense. Consequently, a meaningless set of letters cannot cause hyperaxiomatization.

Similar facts are continuously observed in everyday life. Thus the first option often hinders the correct solution in the same way that the first word or name which comes to one's mind hinders correct recollection. This negative effect of hyperaxiomatization is still more pronounced in the formulation of various hypotheses, as the first one may be so highly evaluated that other options are either rejected off-hand or even pass unnoticed. This is clearly the case in the experimental research conducted by Joseph Kozielecki (197) of Poland, who studied verification of hypotheses in a so-called probabilistic situation where the subject is in possession of a certain amount of data but does not know which data are true and which are not. In most cases the subject believes that the information which corroborates his hypothesis is correct while anything in conflict with this hypothesis is false. For this reason the subject cannot adequately assess the hypothesis

and see facts conflicting with it. In Kozielecki's opinion, these factors prevented many scientists from critically viewing their own theories.

Kozielecki attributes these facts to the action of a presumed "self-corroboration mechanism" which is regarded as a possible internal law of mental activity. By virtue of this mechanism, the subject regards his own hypotheses put forward during the search for a solution to a task, as the most authentic. The facts described by Kozielecki appear to illustrate one of possible hyperaxiomatization effects at work; hyperaxiomatization also occurs, however, in those cases when the results of mental activity cannot be considered in terms of their authenticity. The rather narrow interpretation of the internal mechanism as an "amplifier of the feeling of truth" (authenticity) was probably dictated by the specific phenomena which were investigated by Kozielecki. We prefer to speak of increased evaluation of any successful (in the subject's view) mental activity, such as sentence composition, anagram solution, formulation of hypotheses, etc.

Kozielecki's data are supplemented by the findings of British psychologists P. C. Wason and P. N. Johnson-Laird (272), who studied behavior in the context of information conflict. The subjects were told, first, to choose one of four possible data sources to determine whether a rule is correct; second, to estimate the extent to which these sources supply useful information on the rules. Because almost all subjects initially chose the source incorrectly, the second stage resulted in a conflict; the results of evaluation contradicted the results of choice. Certain subjects were found to be unaware of the conflict and seemed to avoid evidence indicating their incorrect choice.

Wason and Johnson-Laird believe it to be very important to explain "*the frequent domination of the selection process over the evaluation process*" (my italics.—I.R.); in other words, why the *first* decision proves so tenacious and stable that it defies logical arguments. Wason and Johnson-Laird attribute this fact to "*the selection process*" which "is equivalent to a 'self-instruction' and which "...may function like an autonomous plan" (272, 513-514). In this case the authors resort to the theory of G. A. Miller, E. Galanter, and Karl Pribram. Paradoxically, this explanation fails to answer the question posed by the authors themselves, namely what were the reasons for the preference given to the first decision? For "self-instruction" could with equal justification contain a requirement that the

results of the process of evaluation rather than of choice should be preferred.

In our view, it would be more logical to regard the fact reported by Wason and Johnson-Laird as a hyperaxiomatization effect whereby the results of choice activity at the first stage are given an increased evaluation which prevents the subjects from seeing the logical conflicts that are revealed at the second stage through evaluating. In this experiment, as in that reported by Koziellecki, the interaction of the anaxiomatization and hyperaxiomatization mechanisms is obvious: the exaggerated evaluation of the results of one activity (the subjects' hypotheses in Koziellecki's experiment and the chosen source of information in the Wason and Johnson-Laird's experiment) inevitably entails devaluation of other information (resp. the actual data that are in conflict with the hypotheses and the logical analytical results).

What is important is that some authors do not develop any theories for explaining the preferences displayed in their experiments but relate them to various exogenous factors which, though having a role to play, conceal the inner mechanism. Thus in analysing the decision-making process of businessmen R. M. Cyert, Herbert Simon, and B. D. Trow note that they often have neither the time nor the desire to exhaust all the options, and so they settle for the first one which leads to the goal. Yair Aharoni emphasizes that in such cases the search for options is in a way "short-circuited" by adopting a plausible option as a correct one and rejecting the rest as false (106, 4). The strictly experimental facts which, in our view, are satisfactorily explained by the hyperaxiomatization mechanism, should be supplemented with the profound psychological observation made by Jaroslav Havelka: "When an expression is formulated which is stylistically new, it is accompanied in the artist's mind by an experience which is felt as a confirmation of the anticipation. It becomes a discovery of a pre-established image, a permanent opening into a realisation of 'intuitive' certainty" (178, 102). In effect, Havelka directly asserts that generation of something new in one's mind is accompanied with a "feeling of confirmation" which strengthens the confidence of the creative personality.

Can the same hyperaxiomatization mechanism be seen behind these facts? Thorough analysis of at least some forms and techniques of creative activity is needed to answer this question.

PSYCHOLOGICAL SPECIFICS OF ANALOGY AND LITERARY TROPS

Let us start our consideration of creative techniques with analogy which is employed in different forms in literature and fine arts (its varieties are personification, comparison, and allegory). As shown in Chapter II, analogy is used in the sciences not only to illustrate unusual phenomena and complicated ideas but also to design theoretical models, while in psychology the very concept of analogy has often been employed as a principle which is presumed to explain the origin of new images and ideas.

Let us recall that one of the most consistent adherents of explaining the phantasy phenomena by analogy, H.G. Barnett, was led to the conclusion that in making analogies "we are constantly equating the data of our experience" and "ignore the innumerable variations among them [objects.—*Ed.*] and disregard the quantitative and qualitative changes" (115, 191). Barnett may seem to approach the idea of anaxiomatization very closely. Indeed, the process he describes of ignoring variations and numerous changes amounts to their devaluation, thanks to which similarity may be established between apparently different phenomena. However, Barnett fails to draw this conclusion.

It is, however, the most striking feature of the creative approach that similarity is detected in those cases when it is very much camouflaged and an analogy is made between apparently different phenomena and objects. Thus Newton noted an analogy between the fall of an apple and the motion of the planets by virtue of his phantasy. To perceive this analogy, a tremendous number of features that create the impression that a falling apple and celestial bodies on their way through space have nothing in common had to be rejected or devalued.

Consequently, valuable and scientifically significant analogies appear as a result of the anaxiomatization of unimportant, accidental features of the objects to be compared. Some important features can, however, also be subjected to anaxiomatization; this results in so-called non-rigorous and incomplete analogies. In scientific thinking such analogies are characteristic logical fallacies (to be discussed below). On the other hand, incomplete analogies (in which the compared objects have more different features than similar ones; moreover, while similar features may be insignificant), often act as very widespread artistic techniques of comparison and trope.

An artistic (literary) *comparison* is usually defined as the identification of one object with another; psychologically, it is

important to note that, as a rule, the number of common features of objects between which analogy is drawn is severely limited. Thus in describing a beautiful girl in his *Hebrew Melodies* Byron uses several comparisons and allegoric expressions with different objects, each depicting just one feature in the appearance of the fair lady:

*She walks in Beauty, like the night
of cloudless climes and starry skies;
and all that's best of dark and bright
Meet in her aspect and her eyes...
One shade the more, one ray the less
Had half impaired the nameless grace
Which waves in every raven tress...
The smiles that win, the tints that glow,
But tell of days in goodness spent...*

We can thus see that comparison by analogy is achieved by an axiomatizing most of the features whereby the objects of comparison differ. The stability of many comparisons and their charm are obviously attributable to the other mechanism of phantasy, hyperaxiomatization.

Another variety of analogy employed in fiction is a group of figures of speech denoted as tropes, or words and expressions used figuratively. They include metaphor, metonymy, antonomasia, synecdoche, and personification.

A metaphor is a figurative use of words derived from some similarity (the heart of the matter, the murmur of the sea). "In the process of creation, the metaphor brings together phenomena which have no causal nor, apparently, any, even remote, connection," wrote B. Meilakh, a Soviet literary critic and specialist on Pushkin (36, 96). Indeed, the formation of a metaphor involves, as a rule, the identification of insignificant similarities, while the prevailing dissimilarities are ignored. This is probably what Stevens has in mind when he says that "resemblance in metaphor is an activity of imagination" (255, 73).

In using metonymy we neglect differences between words in their direct sense and significance when we say, for instance, "crowned with laurels" implying "the victor".

In antonomasia the difference between the generic and the species notion is neglected; thus Xanthippa, a proper name, stands for "a nagging wife"; an opposite case of replacement is the use of the common noun "the Philosopher" in mediaeval literature to denote Aristotle.

Synecdoche is replacement of a word which denotes the whole by one which denotes a part and conversely (for instance,

hearth meaning family life or home). In all cases of synecdoche the difference between the whole and the part is neglected.

In some literary genres, such as fables, personification is a widely used figure whereby inanimate objects are given the attributes of living beings such as sentiments, desires, the faculty of speech. An important prerequisite for personification is, obviously, the neglect of the difference between animate and inanimate objects.

Consequently, for all their variety, these kinds of tropes have the same psychological trait, namely that some real features, relations or differences are *neglected*, or *devalued*. In other words, psychologically tropes result from the anaxiomatization of some features (qualities or relations of objects) which culminates in *identification*, a kind of equalising, of different substances such as part and whole, words of widely differing meanings, animate and inanimate objects, etc.

In the process of phantasy real sizes and proportions may also be devalued, which results, in literature and the arts, in the well-known phenomenon of hyperbole, or exaggeration, or, conversely, minimization of the size and other characteristics of objects or their parts. Here, anaxiomatization may be applied to real quantitative characteristics; thus in mythology and folklore of some peoples deities may have many arms, legs or breasts. Neglect of realistic quantitative features is also characteristic of modern literature and art.*

Recognizing anaxiomatization as the psychological mechanism of tropes, we may also expect hyperaxiomatization effects, since the two mechanisms are complementary.

Studies of literature confirm that tropes are, as a rule, very *stable* and are used by many generations almost intact, especially in folklore. Gusev, a Soviet folklore researcher, has emphasized that "it is its traditional nature, stability, and repetition of elements that make folklore uniquely attractive and give aesthetic satisfaction to both the performers and audience" (20, 227). Folklore methods are, strange as it may seem, employed in today's fiction. Thus Charles Paul Mauron, the founder of "psycho-criticism", has analyzed the texts of many French authors and detected so-called obsessive metaphors, individually characteristic of each of them (212, 9).

* Attempts to reduce the psychological nature of literary tropes to association by similarity and contiguity by Osborn (223, 113) and B. Kublanov (27, 107) fail not only because they do not cover all the phenomena but chiefly because they do not explain the key point—the "equalization", in some respect or other, of quite different phenomena.

Stability and repetition of way of performing an activity can be explained either by the uniqueness of the given method (as a result of the lack of equally efficient or better methods) or by preferences given to it. The first reason does not seem plausible for tropes which are generated, as we have seen, when there is the slightest similarity between the objects; this would make several more or less equivalent versions possible. However, if uniqueness is not the reason, then we can only assume that its stability is attributable to the preference given to it, which, in the framework of our theory, is dictated by enhanced evaluation.

Specific creative methods such as analogy and tropes can thus be seen as psychologically related to the anaxiomatization and hyperaxiomatization mechanisms. Let us now look at symbolism, a more involved artistic device.

SYMBOLS IN THE LIGHT OF THE PROPOSED THEORY OF PHANTASY

The discrepancy of views concerning the essence of symbols makes their psychological analysis difficult. According to the latest dictionaries, symbols serve as the "conventional denotation" of some concept, idea, artistic image, or some quantity. In this interpretation a symbol is almost identical with a sign, which is defined by some authors as "something that stands to somebody for something in some respect or activity" (229, § 228).

Following other authors, Gilbert Durand, a French researcher into symbols, has noted that terms such as image, sign, allegory, symbol, emblem, parabola, myth, drawing, figure, icon, idol, etc. are often used interchangeably. Comparing them in his *L'imagination symbolique* Durand tries to unravel the specific attributes of symbols as distinct from signs, allegories, and emblems. He believes that symbols are used to represent what cannot essentially be imagined as a sensually perceptible thing and is "a representation which reveals a secret meaning" (145, 6-9). By virtue of this ability of symbols to cause visualization of what cannot be expressed (Durand refers to this ability as epiphany), they are extensively represented in the sphere of the subconscious (as in the symbolism of dreams), in images of the supersensual and supernatural, and in the work of surrealists. Symbols thus act as a special form of cognition as well as representation.

Theodore Thass-Thienemann, who holds a similar view of the role of symbols in cognition, attributes to them functions which are not inherent in signs or other signals. Although he generally

shares the views of psychoanalysts, Thass-Thienemann disagrees with Freud, who asserted that the symbolism of dreams serves to conceal their genuine contents; Thass-Thienemann believes that, on the contrary, symbols make it possible to penetrate adequately the depths of the subconscious, that symbols do not hide dreams but on the contrary, disclose the essence of their meaning (260, 78).

Like Durand, Thass-Thienemann distinguishes symbols from signs understood in the narrow sense of the term. While signs, in his view, have an arbitrary and accidental form and are "understood" also by animals, since they invoke senso-motoric responses, symbols are comprehensible only to human beings; their nature is historically conditioned and full of significance; for this reason they can serve as a tool of thinking (260, 18-24).

Some researchers also note the emotional significance of symbols. Thus Soviet literary critic Averintsev emphasizes that symbols feature "the warmth of unifying mystery" by virtue of the fact that they have "a certain meaning intimately fused with the image but not identical with it" (7, 826-827).

Consequently, some authors favor the idea of a special symbolic function which is irreducible to a cognitive or an emotional function. According to Havelka, the symbolic function activates different levels of the mind's structure (178, 79). Malrieu believes that a major symbolic function is enhancement of the feeling of security by removal of uncertainty in various situations; thus by symbolic representation of his desires the primitive man created an illusion of his power over events, and thus strengthened his certainty of success (211, 56-57). When it is shared by many people, the symbol helps the individual overcome his isolation and whatever handicaps his participation in group life (211, 75).

A symbol is thus regarded by many researchers both as a *product* of phantasy (creative activity) and simultaneously as a real *instrument* for tackling both creative and everyday problems. In Ancient Greek, where this word originates, "symbol" denoted a dozen different concepts such as a signal, omen, hint, a pledge or security, designation of a rank, tag, entry permit, password, allegory, and even an international treaty.

In effect, literature on this subject proposes various interpretations of symbols, which are supposed to perform various functions. Moreover some researchers speak of a special "symbolic function". Is it possible, however, to specify any characteristic psychological feature inherent in symbols which would be independent of their interpretation and linked to any of the above functions? Such a feature would appear to be the ability of symbols to act as a *substitute* for some entity. Moreover,

we tend to see in this feature the basic *psychological function* of symbols. Let us consider different conceptions of symbols from this point of view.

The widespread understanding of a symbol as a conventional labelling of something (concepts, ideas, images, etc.) presumes its ability to act as a convenient substitute. Thus a particular sign stands for an extensive expression of a complex thought or formula, a conventional pattern stands for an idea, and road signs act as verbal commands, warnings, etc.

Substitution is implicitly presumed to a still higher degree in those conceptions which stringently distinguish symbols from signs proper and associate the former with specific functions such as figurative representation of objects and phenomena of the real world, of what is not accessible to the senses and even non-existent.

Indeed, representations such as sculptures, drawings, engravings, etc. can be viewed as substitutes for the real object in some respect and for some purposes. Furthermore, to represent something sensually imperceptible or even non-existent, those tools which only "represent" are insufficient (for there is, in effect, nothing to represent); such tools should obviously act as these objects and, consequently, what we have in this case is not merely substitution but *compensation* with the symbol. In "magic" practices the symbol replaces, as a rule, the real object; moreover, as Thass-Thienemann and other researchers indicate, the symbol is regarded as a substance identical with the object. Finally, symbols which are believed to have a creative impact invariably function as substitutes for many impressions both in the conscious mind and in the sphere of the subconscious.

The above arguments confirm that, although the essence of symbols is understood in different ways, in all these interpretations the characteristic psychological feature of symbols is their ability to *replace* objects.

As a result of the substitution, symbols sometimes act as entities, equal, in some sense, with real objects, as is the case of using physical and mathematical symbols.

What is it, then, that makes substitution possible? An answer to this question will undoubtedly shed light also on the psychological nature of the appearance of symbols.

Replacement of one material object by another, the simplest case of substitution, presumes that both objects are equivalent. In some cases it is the appearance that counts; a child is quite happy when he receives a new identical ball instead of a lost one, an example supplied by Mavit (213, 38).

If, however, one attaches great importance to the "individual" attributes of the object the latter cannot possibly be substituted. An object of love or strong affection is irreplaceable, for the subject does not accept a substitute for objects whose value is exceedingly high in his eyes and whose features cannot be devalued. These examples give an insight into the close relation of substitution and evaluating attitude.

In symbolization the subject is content with a substitute which is noticeably different. The essential feature of such replacement is downgrading, neglect of the differences between replaced object and its substitute. This is evidence of the direct dependence of substitution (replacement) on an axiomatization, which enables symbols to work.

Consequently, the generation of symbols which act as substitutes is linked to the axiomatization mechanism. On the other hand, the hyperaxiomatization mechanism is also very much in action.

Many ancient peoples worshipped fetishes, various objects, chiefly manufactured, that were genuine symbols. We believe that this cult cannot be explained by the fear that primitive people experienced in face of elemental forces, for the fetishes were not terrible or uncontrollable forces but hand-made objects, still more "helpless" than their creators who could dispense with them in any conceivable way. Fetish worship can probably be traced back to the increased value attached, as shown above, to creative activity and to perception of its products.

Many authors have emphasized the importance attached to symbols down the centuries, the worship given to them, and the belief in their prowess; many symbols go from generation to generation intact. All of this clearly reveals that symbols are given an enhanced assessment.

SOME GENERAL ATTRIBUTES OF CREATIVE ACTIVITY IN THE LIGHT OF THE PROPOSED THEORY

Above we tried to reveal the effects of the proposed axiomatization and hyperaxiomatization mechanisms in the psychological features of three creative tools: analogy, tropes, and symbols. Now we propose to consider some other, more general features of creative activity in the same light. This analysis makes no claim to be exhaustive or systematic; we merely wish to draw in more facts which illustrate and corroborate the ideas put forward in this book.

First of all, let us take up the psychological specifics of

schemata and schematic representations. Schemata are, as a rule, regarded as relatively primitive products of imagination; thus, literary critique opposes full-fledged literary characters to schemata, and the expression “schematic thinking” is a derogatory term. A schema is usually understood as a very generalized representation of objects or processes, interrelations between parts of objects and certain conditions of their functioning (for example, the scheme of a machine, technological schemes, etc.). Development of schemata obviously requires *neglect* of those details which are of secondary importance.

Another widely known kind of phantasy are *caricatures* in the widest sense of the word. In graphical cartoons the correct proportion of parts of the human body and face is clearly devalued. Caricature images are also quite common in fiction, where the negative traits of characters are brought to the fore by discarding others; this was the case with Shylock’s greed, King Claudius’ baseness, etc.

Consequently, both schemata and caricatures are created through an axiomatization, which plays an important role in any creative activity, including that of realistic artists who are in no way striving to create cartoon images and even less schematic representations.

This is what outstanding Russian authors had to say on this subject. Ivan Goncharov wrote: “No writing is done completely from nature, otherwise it will come to nothing, have no effect. Like serving raw beef. In a word, one has to condition, clean, sweep, remove” (84, 103).

Fyodor Dostoevsky repeatedly emphasized the importance of deleting whatever is unnecessary to the artistic concept. He wrote in a letter: “The highest skill of the writer is to be able to cross out. Who can and is strong enough to cross out what he has written himself will go far” (84, 165).

The same idea was put forward by V. M. Garshin in his talk with I. Ye. Repin: “The greatest effort for me is removing what is unnecessary. I do it several times with everything I write until I do not see any overload in it which hinders the artistic impression” (52, 387).

Lev Tolstoy repeatedly advised reducing the text. Thus he noted in a letter to P.D. Boborykin: “You ... do not jettison enough from what is written (prolixities), you do not sufficiently resort to technique which, for an epic writer, is the entire wisdom of art—you do not sufficiently sift the sand to obtain pure gold” (31, 100).

While highly appreciating Maxim Gorky’s talent, Chekhov gave him a friendly piece of advice that he could write “in a more

compact and concise way" (12, 241) and eliminate extravagances (12, 248). Gorky himself, who urged the writers to show invention and phantasy, also required them to display characteristic features more vividly (18, 468). This is impossible, however, unless other details, artistically unjustified, are eliminated. As Konstantin Paustovsky recalls, Isaac Babel used to say that the clarity and vigor of the language consist not in that nothing could be added to a phrase but in that nothing could be deleted.

Katherine Ann Porter, an American writer, understood that notes she had taken, that were supposed to be of great help, were actually a hindrance, "I must know a story 'by heart' and I must write from memory" (quoted from 159, 207). This observation is a good expression of the hyperaxiomatization effect whereby an option, once found, acquires increased evaluation and hinders perception of finding other ways of expressing what is in one's mind. This is what probably Dostoevsky meant when he spoke of the difficulty of "crossing out what one has written".

The psychologists who studied the creative process in literature could not overlook the facts which spoke of the need to devalue (anaxiomatize), but, as a rule, related those facts to other theoretical concepts. Thus Spearman writes of "the simple device of exaggeration" which, in his view, explains the attributes of characters. Baseness, the chief characteristic of Iago, is common in everyday life, but Shakespeare strongly exaggerated this trait in his character. In the same way Tennyson gave his Percival an undue allowance of nobility and Dickens made his Pickwick uncommonly well-disposed to the human race (252, 57).

We have just seen that hyperboles and caricatures are based on a neglect of real relations and, consequently, the mechanism of which Spearman speaks can be regarded as a particular case of anaxiomatization.

The proposed mechanisms of phantasy seem to account for many phenomena in the psychology of the language, arts, and sciences. It is common knowledge that people who learn a foreign language initially use their mother tongue as a "medium" in that they translate foreign words and sentences into their own language and coin sentences in the foreign language as they do in their own. Karl Marx, who knew numerous languages, described this phenomenon as follows: "a beginner who has learnt a new language always translates it back into his mother tongue, but he has assimilated the spirit of the new language and can freely express himself in it only when he finds his way in it without recalling the old and forgets his native tongue in the use of the new" (3, 104).

"Forgetting one's native tongue in the use of the new" signifies devaluation of the transfer of laws and rules from one language into another. Some psychologists explain difficulties in learning a foreign language by a heightened evaluation of one's native language. Thus Mavit asserts that "a very strong love for the native language ... makes learning living languages more difficult" (213, 40).

Consequently, successful learning of a foreign language and correct translation involves anaxiomatization which, in this case, suppresses extension of the features of the native language to a foreign language.

Ascertaining the contribution of anaxiomatization and hyperaxiomatization in painting, music, and scientific discoveries will not be possible unless a special, comprehensive effort is made to examine appropriate material in the light of the proposed concept of phantasy. Thus far in most papers on the history of arts and sciences the psychological aspects have been treated within the framework of traditional theories: the facts have been selected accordingly. Thus in his books on the psychology of musical creativity, M. Graf squeezes the entire body of experimental data into the framework of several, eclectically pieced together, philosophical and psychological theories. On the other hand, in researches not written to prove some fashionable psychological or philosophical concept, the authors provide interesting clues concerning the proposed mechanisms of phantasy. Such is *The Story of Art* by E. H. Gombrich, who attempts a comprehensive approach to different schools of painting, from its inception to the works of modern artists (164). Examination of a tremendous body of facts led him to a basic formula: "Each generation is at some point in revolt against the standards of its fathers; ...The urge to be different may not be the highest or profoundest element of the artist's equipment, but it is rarely lacking altogether" (164, 2). This implies anaxiomatization and somewhat further into the book he hints at hyperaxiomatization: "every artist feels that he has surpassed the generation before him and that from his point of view he has made progress beyond anything that was known before" (164, 3).

The artist's creative accomplishments and successes, according to Gombrich, are explained by his urge and ability "to see the world afresh, and to discard all the accepted notions and prejudices about flesh being pink and apples yellow or red. It is not easy to get rid of these preconceived ideas, but the artists who succeed best in doing so often produce the most exciting works" (164, 10).

As for scientific discoveries, a frequently cited case of a scientific feat is Torricelli's discovery of air pressure and the possibility of a vacuum. Explaining why it was Torricelli, not his teacher Galileo, who clarified why a pump could not take water higher than a certain level, a fact discovered in early 17th century, Donald Hebb, a US psychologist, declared: "Torricelli who did find the answer, performed an intellectual feat of the first order by *abandoning* (my italics.—I. R.) a principle that others were working with ('Nature abhors a vacuum')" (180, 304), which Galileo himself shared. Hebb fails, however, to see a more profound mechanism behind this fact.

Arnheim analyzes the psychological mechanism of a "scientific feat" with reference to Copernicus's discovery and concludes, quite correctly, that "Copernicus had to *free himself of the suggestions* (my italics.—I. R.) imposed upon him by the directly given astronomical image". What now apparently remains to be done is identify the technique of freeing oneself from observation-imposed images, a technique whereby these images and the ensuing assumptions are devalued; but Arnheim's analysis went on along a different line: "He (Copernicus.—I. R.) also needed a remarkable visual imagination which let him light upon the idea that a model of very different appearance could be applied to the situation he saw" (111, 91-92).

The psychologist Taylor, who tried to unravel the psychological aspect of another scientific feat, Einstein's discovery says that the genius of the founder of the theory of relativity was in his inability to understand what is obvious, "the rejection of one's own and other people's superficial explanations and the ability *to know when you don't know* may be crucial to making original contributions" (258, 21). The words italicized by Taylor move his own "rejection" concept to the background where it is, presumably, to play an auxiliary or preparatory role. However, Einstein himself was more positive. He described his method of processing the welter of knowledge he had to acquire in his student years as follows: "The mass of insufficiently connected experimental data was overwhelming... In this field, however, I soon learned to scent out that which was able to lead to fundamentals and *to turn aside* (my italics.—I. R.) from everything else, from the multitude of things which clutter up the mind and divert it from the essential" (147, 17).

We also believe that Einstein had in mind another beneficial effect of an axiomatization, namely overcoming an habitual way of thinking and deeply rooted views and convictions, when he explained why it took him seven years from inception of the

fundamental idea of the general theory of relativity to a final formulation: "Why were another seven years required for the construction of the general theory of relativity? The main reason lies in the fact that it is not so easy to free oneself from the idea that co-ordinates must have an immediate metrical meaning" (147, 66). Thus in order to take an important step towards the creation of a new scientific theory, he had to "free himself" from earlier views and ideas, or to devalue them.

Some scientists deliberately resort to techniques which amount to an axiomatization in order to obtain the desired effect.

Researchers into invention psychology, such as Boirel and Kaufmann have convincingly shown that the introduction of technological innovations often requires rejection of dominant hypotheses and theories (128, 82-84).

A. N. Tupolev, an outstanding Soviet aircraft designer, speaking of decision-making factors in a conversation with psychologist P. M. Yakobson, said: "One has to have a new look at things, at one's own thinking process, at technical designs, and at the methods of problem solution we traditionally use. One has to look as if through someone else's eyes, breaking away from the usual, habitual scope" (quoted from 100, 117). These approaches obviously proceed through at least relative or temporary devaluing of "habitual" techniques and opinions. In that same conversation Academician Tupolev also gave a fairly accurate description of the hyperaxiomatization mechanism: "A decision is made with a certain assumption of its correctness, soundness, obviousness, and with confidence in it. With time, say, in a year, I shall probably reject it, it will seem incorrect to me... But when we work at it and find it, it is regarded as correct" (100, 117).

In conclusion of this section let us take up some paradoxical facts that have been repeatedly described and even explained, and which still remain ununderstood. We have in mind the mutual enmity of scientists working in the same field, mutual "denial" of creative achievements, mutual "shunning" of creative work on the part of people who apparently express the same social and artistic trends, have similar scientific views, etc... S. O. Gruzenberg* believes that differences of "emotional

* He illustrates his point with the following examples: "Newton could not grasp Huygens's explanation of light in terms of wave-like motion of the ether; Huygens could not understand Newton's teaching... Tolstoy did not understand Shakespeare... Schopenhauer refutes Hegel, Mérimée derides Hugo, and Knut Hamsun, Walt Whitman, Nietzsche debunks Schopenhauer and Wagner" (19, 20). Other characteristic examples are the mutual dislike of the two giants of the Renaissance, Leonardo da Vinci and Michelangelo and of the ideologists of the French bourgeois revolution, Rousseau and Voltaire, and Einstein's long-standing mistrust of statistical physics, etc.

and intellectual attitudes" are to blame (19, 25). But then this explanation invites a new question: what is it that causes a negative emotional attitude towards creative personalities (and to their products) on the parts of their colleagues, quite capable of a sound intellectual judgement.

In our view, this phenomenon is caused, among other possible reasons, by the unity of the proposed mechanisms of imagination: hyperaxiomatization of one's own creative techniques and findings may result in an axiomatization of those of others.

In discussing some scattered and diverse facts drawn from creative activity in literature, arts, science, and technology, we were interested in answering only one question: can the proposed inner mechanisms be detected behind these facts? In our opinion, the results justify a positive answer.

As this book cannot exhaustively analyze all the facts of scientific creativity in terms of the proposed phantasy conception, let us look more closely at just one creative tool, abstraction and concept formation.

ABSTRACTION AND CONCEPT FORMATION

Abstraction is regarded by nearly all psychologists as crucial in mental activities. Karl Marx's formulation of abstraction as an important instrument of cognition having in theoretical sciences the same role to play as the subtlest techniques and sophisticated tools have in the natural sciences is common knowledge. In his preface to the first volume of *Capital* he wrote, "In the analysis of economic forms, moreover, neither microscopes nor chemical reagents are of use. The force of abstraction must replace both" (1, 19).

As was the case with many other scientific problems, abstraction was initially taken up by Aristotle, who viewed it as a process whereby particulars are screened out and the general is extracted. He used the word "aphareisis" which meant "taking away" (quoted from 230, 9). Following Aristotle, philosophers and psychologists closely relate abstraction to the extraction of the general and formation of general concepts.

Early attempts to explain the phenomenon of abstraction include the so-called repetition hypothesis of John Locke and its modified version, the theory of collective photographs proposed by Francis Galton. Locke wrote: "Thus the same colour being observed today in chalk and snow, which the mind yesterday received from milk, it considers that appearance alone makes it a representative of all of that kind" (205, 177). William James,

who criticized this view, was quite right when he said it remained a mystery "why the repetition of the character in combination with different wholes will cause it thus to break up its adhesion with any one of them" (191, 507).

Many psychologists have tried to explain abstraction in terms of attention (e. g. Ribot) but, as Pierre Oléron noted correctly, it is then necessary to determine why the subject voluntarily concentrates his attention on some rather than on other objects (222, 42).

Some psychologists tried a purely logical analysis of abstraction. The pitfalls of this approach have been described by B. Inhelder and J. Piaget: "On the one hand, we cannot determine what properties are common to a set of elements, ... by studying individual members in succession because we could not be sure of abstracting correctly until we had examined all members of the group, which is most often impractical or impossible. On the other hand, we cannot pick the particulars, to be examined in the first place without establishing some common property by which to choose them" (189, 284). In other words, to see the general, it is necessary to study all elements of the group and choose the appropriate characteristic, whereas the choice presumes establishing the generality. Paradoxically, the logical explanation of abstraction contains the logical flaw known as a vicious circle.

In the early 20th century the psychological aspect of abstraction became an object of intensive experimental study in the context of research into the nature of concepts. Thus Anatol Pikas noted "a decline in the use of the term 'abstraction', which is being increasingly replaced by 'concept formation'" (230, 64).

Moore, S. C. Fischer and C. L. Hull, and T. S. Kendler, consistent adherents of the strictly associative view, consider a concept as an ensemble of links between the organism's response and some common features (properties, attributes) of the stimuli. With repeated confirmation of the correct response in the presence of certain features (attributes) of the stimuli, the links of the ensemble become stronger while other attributes of the stimulus (irrelevant, continuously variable or insignificant for the particular response) are, as Robert Woodworth puts it, "washed out" (278, 801).

The chief criticism of the associationist concept is that the subject plays only the role of passive observer, and concept formation is dictated entirely by exogenous and purely random signals (278, 801; 269, 106). The associationist concept of repetition is counterposed by the so-called active search theory (also referred

to as "the hypothesis theory" of concept formation) whereby a concept is the outcome of conscious activity by the subject, who generates hypotheses on the available information, both hereditary and gained via experience. This theory is echoed by Ribot, who traced abstraction to voluntary attention.

Both these theories are opposed by Bruner, Goodnow, and Austin, according to whom the abstraction mechanism is to be explained in the context of all productive mental activity (including inventions and discoveries) and as an elucidation of its inner laws (134).

Bruner et al. give prominence to decision-making strategies but this only emphasizes the need to find the laws which dictate the choice of strategies or the preference of some over others, etc.

It is probably because intellectualist conceptions did not satisfy the researchers that in the mid-1960s they were largely abandoned and new explanations were sought. The opponents of Bruner et al. noted that these had essentially studied only the concept acquisition, disregarding concept formation. Pikas wrote that the mechanism of the phenomena should be sought in the working of the memory, to be more precise, in recodings of primary code, or memory traces which result from the action of signals at the sensory input. To put it differently, recoding generates new codes which embody the overall structure of primary codes (230, 154). Pikas does not elaborate on this mechanism but puts forward many arguments which, in his view, confirm the existence of a "recoding hypothesis". In these terms he explains the stability of concepts and the need for a certain time to elapse before they are formed (both being viewed as dependent on the autonomous nature of encoding occurring in time); on the other hand, the observation in memory activity of "simplification" and "normalization" are assumed to fit into the recoding model.

Pikas repeatedly speaks of similarity as the decisive variable in recoding (230, 128-129). As a result, we again face the problem of similarity and analogy.

While Pikas tries to explain the abstraction (and concept formation) process by memory mechanisms, Arnheim, whose views of creativity have been described in Chapter II, tries to make use of perception mechanisms. Echoing the views of Bruner et al. on categorizing as a means of reducing variety, Arnheim asserts that the "static concepts" which result from abstraction facilitate the approach to phenomena because "at early cognitive levels the mind is not yet able to 'handle much complexity..." (111, 179). Following Pikas, he objects to treating abstraction

and generalization as the outcome of stimulus "blurring" (111, 168).

According to Arnheim, abstraction is an important immanent process in perceptive activity and the traditional belief, which can be traced back to Locke, that the concept is not truly abstract unless it is free from any admixture in the form of images and other effects of the perception process, is fallacious. Thus a simple line can be regarded as an extremely abstract formation because no geometrical lines or, indeed, any one-dimensional objects, exist in nature; however, by representing something as lines one depicts the perceived form. In the perception process itself "concepts tend to crystallize into simple, well-shaped forms" (111, 167–168, 178).

The explanation of abstraction as the product of perceptive mechanisms is, in our view, inconsistent. On the one hand, the mechanisms are assumed to be responsible for the generation, within certain limits, of identical images of the same objects. In all normal subjects, for example, perception of the same object under identical conditions results in the same visual image. On the other hand, by abstracting people often arrive at different results even if they perform this activity under the same conditions. This is why we do not think it plausible that perception mechanisms, which are supposed to "unify" the various forms by "levelling out the deviations", can condition a process which is marked by quite the opposite feature, namely ambiguity and diversity of results.

Some researchers have also tried to explain abstraction in physiological terms. Richard Thompson summarized the latest literature in this field and identified two fundamental physiological explanations of concept formation. Most physiologists follow Hebb, according to whom general notions (percepts) and concepts result from learning and are associated with exceedingly complex interactions between neuron groups. On the other hand, D. H. Hubel and T. N. Wiesel believe that their experiments with newborn kittens suggest the existence of neurons in which complex visual concepts such as lines and angles are already encoded even at birth. In this approach the entire problem of concept interpretation is restructured, for it is the ability to use them rather than their formation and assimilation (for they are stored in brain cells) that is crucial (261, 59–64).

Other attempts to explain the abstraction process include the view that concepts are generated as a result of special abilities. But, as Pikas notes, they "seem at present to be unable to contribute to a theory of the mechanisms underlying these abstractions" (230, 97).

To summarize, once the psychologists abandoned the mechanistic explanation of abstraction in terms of exogenous circumstances (Locke's repetition hypothesis and Galton's "theory of collective photographs"), abstraction was supposed to depend on all kinds of mental processes, such as attention (Ribot), mental strategies and decision-making processes (Bruner et al.), memory (Pikas), perception (Arnheim), and, finally, abilities (some physiological concepts). All these explanations are, however, theoretically inconsistent.

In our view, the mechanisms of anaxiomatization and hyperaxiomatization are clearly at work in abstraction and concept formation. Thanks to the former mechanism *insignificant* attributes of the phenomena and objects of the real world are devalued and so meaningful features come to the fore. Anaxiomatization can certainly be applied to a smaller or greater number of attributes and details and, as a result, different levels of abstraction are observed in that, the more features are devalued, the more abstract the concepts are.

This is a *psychological* process, whose results are not always equally valuable, in logical or general cognitive terms; anaxiomatization might fail to devalue all secondary details, producing imprecise or inconsistent results. The nature of abstraction thus depends on the *direction* of anaxiomatization. Hyperaxiomatization, which goes hand in hand with anaxiomatization, ensures the stability of the newly generated mental formations, or concepts. True, this stability has a negative aspect of which psychologists are well aware; as Boirel, for instance, noted, "a concept is simultaneously an instrument of cognition ... and an obstacle to this cognition in that it stands between the questing subject and the being" (129, 19).

In his famous philosophical passage "On the Question of Dialectics" Lenin discussed the relations of the contingent and the necessary, the phenomenon and the essence, and emphasized the need to reject contingent features so as to separate what is significant from "the appearance". "Every individual is connected by thousands of transitions with other *kinds* of individuals (things, phenomena, processes), etc. *Here already* we have the elements, the germs, the concepts of *necessity*, of objective connection in nature, etc. *Here already* we have the contingent and the necessary, the phenomenon and the essence; for when we say: John is a man, Fido is a dog, *this* is a leaf of a tree, etc., we *disregard* a number of attributes as *contingent*; we separate the essence from the appearance, and counterpose the one to the other" (6, 361).

What has been said above suggests that the major tool of scientific creativity—abstraction (concept formation)—and various tools of artistic creativity are implemented through the inner mechanisms of anaxiomatization and hyperaxiomatization. These mechanisms, however, must explain not only the positive effects described above, but, if they are to be adequate in terms of the general methodological principles of Chapter III, must also be capable explaining negative effects. The best explored among such negative effects are imperfect (children's) drawings and logical fallacies.

NEGATIVE EFFECTS OF THE PROPOSED MECHANISMS OF PHANTASY

A lively discussion is still underway on the causes of the specific nature of children's drawings, their primitiveness, disproportion, omission of many important details and the conventional representation of objects and their parts, a head as a circle, for example, legs as straight lines, etc.

The first attempts to explain this phenomenon were made by A. Hildebrand and E. Löwy, who attributed these features to the inclination of children and, for that matter, of ancient painters, to rely on the blurred images of memory which were supposed to be generated by the blending and condensation of numerous impressions. Because many details are "blurred", memory is, as it were, compelled to rely on a few of the most pronounced details, and this inevitably results in schematic and primitive images. Commenting on such reasoning, which emphasizes the "imperfection" of memory, Gombrich has every right to say that "none of us ... carries in his head such schematic pictures" (163, 23).

The mechanisms of children's drawings have been thoroughly analyzed by Arnheim, who criticizes the most widespread explanations of the fact that children do not draw what they see. He rejects the opinion that children are technically incapable of drawing what they see. He feels that "lack of motor skill cannot explain the phenomenon" (109, 156). Equally inadmissible are, in his view, explanations according to which the preference that children give to simple forms is dictated by the ease of realization or by the fact that "the children's pictures ... are not copies but 'symbols' of real things" (109, 157). His strongest criticism is, however, directed against the intellectualistic theory, which regards children's drawings as expression of "abstract concepts". Indeed, young children perceive the world sensually, whereas abstract

concepts are mastered through special training (108, 158). The specific nature of children's drawings is, according to Arnheim, attributable to the fact that perception starts with the general rather than with the particular. Thus a man recognizes first a dog as such rather than different breeds of dogs. According to Arnheim, "children and primitives draw generalities and undistorted shape precisely because they draw what they see" (109, 160).

Arnheim is, however, aware of the weaknesses of his explanation and hastens to add that "this is not the whole answer" because "unquestionably children see more than they draw"; thus they easily distinguish people, notice even minute changes in familiar objects; nevertheless their drawings remain "undifferentiated". Arnheim believes that the cause of this phenomenon "must be sought in the process of representation". "If I want to represent the roundness of an object such as the head, I cannot use the shapes actually given in it but must find or *invent* (my italics.—I. R.) a shape that will satisfactorily embody the visual generality 'roundness' in the world of tangible things" (109, 160).

Consequently, Arnheim himself admits that the Gestalt psychological theory is insufficient to explain the actual facts and requires the concept of invention, alien to it as a system. This immediately brings to the foreground the question of the mechanism of invention and, as a result, the problem far from being clarified, is simply stated anew.

Many psychologists of the fine arts affirm in one way or another that the process of drawing involves *invention of the representation technique*. Max Liebermann, the well-known German artist, wrote: "Painting amounts to invention of visible forms for thoughts rather than invention of thoughts... I speak of the living form which every artist creates for himself anew. It is in the creation of new forms that the criterion for the creative artist, for the talent, is" (203, 17).

The view that the creativity of the painter lies above all in invention of new artistic tools seems to be most consistently formulated by Gombrich, who wrote: "we dismiss the majority as odd, uncharacteristic, strange" (163, 345) options which do not appear to render nature faithfully. True, sometimes the options can be rejected just because they do not agree with the conventional idea of similarity. "We are inclined to accept conventional forms or colours as the only correct ones. Children sometimes think that stars must be star-shaped..." (164, 10). Finally, the fact that the rejection of some options and details leads to dissimilarity with nature may

be evidence of the fact that the artists "obviously did not find it essential to make ... a correct representation of a man"; thus the ancient Polynesian sculpture of Oro, a "God of War", shows only the eyes and arms, even though "under certain conditions native artists can produce work which is just as correct in the rendering of nature as the best work done in any art class" (164, 25).

Children's pictures and imperfect pictures in general must thus be considered in the wider context of inventing tools of representation. First of all, any representation in the form of a drawing is unthinkable without an axiomatization of certain real features and dimensions (the images may be smaller or larger than life). There are, however, different ways of implementing this axiomatization, and therefore the artist has to choose a particular variant. In this case the choice involves rejection or devaluation both of numerous unsuitable options, and of certain details of the object. The axiomatization mechanism is thus involved in any artistic activity and its value depends on what it is directed towards. In making a choice the artist rejects or devalues, first, numerous options which, in his view, do not contribute to resemblance and, second, those details which either seem superfluous or hinder resemblance. In children's pictures (and generally in the work of untrained people) many actual features are devalued but in most cases, these are details which would contribute to a resemblance; as a result, the images seem "undifferentiated"; "generalized", and schematic. The hyperaxiomatization mechanism, however, makes such artists confident that the representation technique has been chosen correctly.

Let us look at another variety of "imperfection" in mental activity, logical fallacies, the phenomenological aspect of which has been fairly thoroughly explored down the centuries. Aristotle analyzed various fallacious proofs. Logicians of the 19th century gave fallacies serious attention; Jeremy Bentham devoted a book to them, while Richard Whately and John Stuart Mill discussed them in special chapters of their books.

Many authors believe that the causes of logical fallacies should be unravelled by psychology. Thus, one latest manual on logic cites the following causes: mental disorders, poor knowledge of the mother tongue, prevalence of emotions over reason, and, finally, social position (24, 273).

Extensive observations suggest that in real life fallacies are committed by quite normal people, well-versed in their own language, and motivated by the best of intentions. Thus Max

Black emphasizes that "it proves difficult for even ablest and best-intentioned thinkers to conform to the standards of right reasoning" (127, 209). He notes that "correct reasoning is as rare as perfect health".

Undifferentiated concepts such as "mental disorder", "power of emotions", etc., which, moreover, designate unusual states of mind, are thus not helpful in explaining fallacies. The origin of fallacies must be traced to more subtle psychological mechanisms which control "everyday" mental activities.

For psychologists who deny the existence of inner laws, no negative phenomena are of any serious theoretical interests; they treat fallacies as the result of inadequate training, incomplete or incorrect instruction, etc. On the other hand, those psychologists who admit the existence of inner psychological laws did not pay any attention to fallacies. Indeed, both S. L. Rubinstein, who described the thinking process in purely logical terms of analysis, synthesis, and generalization, and the Gestalt psychologists, who explained mental activities in terms of the laws of the perceptive field, have dealt only with correct thinking and apparently avoided the theoretical difficulties which would arise in explaining fallacies.

True, fallacies do not necessarily result from inner psychological laws. This is particularly the case when the thesis is derived from false premises (the so-called "error fundamentalis") or evolved through arguments which themselves need proving ("petitio principii"); in these cases the subject lacks adequate information. This is why we shall be concerned with only those fallacies which occur despite availability of all the necessary information.

Fallacies of this kind are, in turn, classified into several groups (208, 169-180; 24, 272-273, 370-373).

Let us first take up the fallacies which arise in using a conditional (hypothetical) syllogism, a correct conclusion from which is impossible unless 1) from assertion of the premise one proceeds to assertion of the consequence, or corollary or 2) from negation of the consequence or corollary one proceeds to negation of the premise. In other words, one can move from one part of the major premise to another only *with strict observance of the direction*: from the premise to the corollary in assertion and from the corollary to the premise in negation. Fallacies arise when, in asserting the corollary the premise is asserted and in negating the premise the corollary is negated. Replacement of one "direction of thought" by the other results in fallacies. These replacements are possible when

the two opposite directions are equivalent in the subject's mind, i.e., when the *difference* between them is *devalued*. This is an illustrative example of fallacies resulting from devaluation of some aspects of logical rules.

Devaluation of differences is also the cause of other fallacies. Thus the widespread "ignoratio elenchi" fallacy is attributable to neglect of the difference between an assertion to be proved and another thesis similar to it. In another fallacy, the "quarternio terminorum", two concepts are denoted by the same word, which leads to devaluation of the difference between them.

What is instructive is that the description of some fallacies contains direct references to the anaxiomatization mechanism. Thus in describing the fallacy of "a dicto secundum quid ad dictum simpliciter" (whereby a limited assertion is extended to phenomena which are not covered by it) J. Mackie notes that it arises from "invalidly dropping a conjoined term" (208, 171), which is bound to result in fallacies.

Neglect of limitations (qualifications) also causes the phenomenon known as "jumping to conclusions" whereby, through inductive thinking, properties of some members of a class are extended to all the members of that class. Devaluation of qualifications also leads to fallacies such as "a sensu diviso ad sensum compositum" (what is true of parts is asserted of the whole) and "a sensu composito ad sensum divisum" (what is true of the class as an entity is attributed to its parts). The essence of the fallacy "post hoc propter hoc" lies in *confusion* of the causal link with the sequence of events in time. We have tried to show above that an important condition of confusion (mutual substitution) is devaluation of the difference between the objects.

Fallacies such as "ad hominem" and "ad populum" can also be interpreted in a similar manner. In committing this first error the subject ignores the difference between the contents of the proposition and its author. In committing the second error the subject ignores the difference between two addressees of his argumentation; he appeals not to the reason, but to the feelings and emotions of those, whom he tries to convince.

Fallacies in inferences by analogy are also characteristic. Analogy has been seen to arise from the anaxiomatization of certain attributes of two or more objects so that their similarity is established even in those cases where the objects differ greatly at first sight. However, in discarding certain features to establish an analogy, the subject may neglect essen-

tial differences, and as a result the analogy may prove fallacious.

Consequently, the origin of wrong conclusions which do not logically follow from the premises can be directly traced to an axiomatization. It should be remembered that among the facts that first suggested the existence of a specific inner devaluation mechanism (Chapter IV) of particular importance are phenomena comparable with the fallacies discussed above, such as extension of the original relation and changes of its direction through discarding of qualifications. The possibility of linking fallacies to the axiomatization mechanism confirms that the immense body of irrefutable facts that have been established by the researchers over the centuries constitute a strong argument in favor of our proposed mechanism; this explanation also seems to clarify another significant and paradoxical fact, namely, the subject's "insensitivity" to his own fallacies and weakness in his own arguments. This fact is obviously attributable to hyperaxiomatization, which makes the subject sure of the truth of his own conjectures.

Our explanation of fallacies in reasoning and proofs may be countered by the argument that, since many people are simply unaware of the rules of logic, it is pointless to speak of their devaluation. What is important, however, is that all so-called formal logical laws are reflections of objective relations of which people are quite conscious and which direct their thinking processes. Consequently, violation of logical rules bespeaks deviation from the direction which is dictated by reality itself, and we have tried to show that the laws of phantasy can be perceived behind these facts. The strict rules devised to control various forms of thought were, amongst other things, formulated as a means of eliminating the undesirable effects of the phantasy mechanisms.

In this section we have discussed just two types of imperfections that can, in our view, be traced back to the axiomatization and hyperaxiomatization mechanisms. The fact that "imperfections" in the results of activity are attributed by us not to organic or functional disorders, but rather to dynamic principles which also underly positive phenomena, serves as the theoretical basis for our belief that all forms of error may be overcome.

THE TRADITIONAL PROBLEMS OF PHANTASY IN THE LIGHT OF THE PROPOSED MECHANISMS

Discussion of abstraction, concept formation, and fallacies may seem irrelevant to those who traditionally regard phantasy as "...a form of creative, imaginative activity where the images ... are directed and controlled by the whim or pleasure of the moment" (142, 205).

Since phantasy implies in our view any productive mental activity its scope has been significantly expanded. On the other hand, its "traditional" scope, above all so-called fantastic images and plots, must nonetheless be explained within the framework of our theory.

The phantastic in the narrow (traditional) sense has been opposed to the real, and has included unusual and unlikely events and phenomena that are not experienced in everyday life. In one kind of phantasy, science fiction, many events and phenomena, however implausible, still agree with the objective laws of nature. In myths, legends, tales, etc. the objective laws are neglected in narratives which involve impossible transformations and movements, qualities non-existent in material objects, changes in natural dimensions and proportions, and many other things which are in conflict with laws of nature and with experience.

All these characteristic traits of fantastic images and plots can, in our view, be regarded as products of an axiomatization: in science fiction habitual ideas, and in myths more substantial laws are discarded.

It is worth noting that it is precisely in these phantastic creations that the other inner law of mental activity, hyper-axiomatization, is also very much in evidence. Indeed, fantastic ("unlikely" or "implausible") images and plots have a charm, a magic which seems to be a form of over-evaluation. Schuhl who has studied the changes in the attitude of writers and poets to phantastic, the miraculous and the wonderful, has noted the considerable "attraction of the marvellous", which he attributes to the desire of the human mind to relax "following the exercise of rational thinking, which is a severe load" (246, 51).

In Schuhl's research the magical and the miraculous, on the one hand, and the wonderful and strange, on the other, are not differentiated; indeed, for him these concepts would seem to be identical. He is certainly right in making the unusual and miraculous converge, for their uniformity is an

irrefutable fact. As for his argument on the attraction of the unusual, one can hardly agree that imagining the unlikely and thinking about it are easier than using the customary techniques of rational thought.

The close interrelationship of the unusual and the feeling of the miraculous or of wonder is represented in the lexics of many languages in which the same word expresses two essentially different ideas, on the one hand, of the extraordinary and the rare and, on the other hand, of charm and thrill.

Thus the ancient Greek "thaymastos" means both "admirable" or "wonderful" and "strange". The Latin "miror" denotes "to be surprised" or "puzzled" and also "to admire", "to be thrilled". The Russian "divo" implies, according to the Dahl's dictionary, "a rare thing or event" and "a miracle". In the same way the German "sich wundern" can be translated, depending on the context, either as "to be puzzled" or as "to admire". Finally, the English noun "wonder" may imply either a "miracle" or the feeling evoked by something unexpected, strange and inconsistent or conflicting with our experience.

The two different meanings have "merged" to the extent that they seem to denote the same concept with different nuances. But in some languages the words which denote strangeness or the extraordinary do not express the ideas of a miracle or magic.

Thus the Spanish "extrañar" combines the meaning of "to be surprised" with "to exile", "chase away" or even "to reproach" rather than "to admire". In Italian the word which denotes the state of being surprised has a common root with words which mean stupidity and dishonor, "stupire" (be surprised or puzzled), "stupido" (stupid), and "stuprare" (rape). Another Italian word, "strano" means "surprising", "unusual" and, at the same time, "comical" or "laughable". Finally, in Hebrew "tamah" means both "to be surprised" and "to doubt".

Consequently, in many languages the words which denote rarity and unusualness also express ideas of the comical, disbelief, doubt, enmity, etc. These combinations of meanings seem quite logical because encounters with the unusual may provoke apprehension, fear, and other negative attitudes, while narratives of the unusual are naturally greeted with doubt, disbelief and derision, and suspicion arises that the narrator is either stupid or dishonest.

The linguistic data thus seem to bear out the psychological fact that unusual things cause not only doubt, disbelief or apprehension (which is easily explained on pure logical grounds)

but also a feeling of the miraculous or magical. The cause of the close relationship between the unusual and the miraculous can be seen in the unity of the proposed phantasy mechanisms. This relationship may be implied by the authors of folklore or even literary works. In describing what is inconsistent with the everyday experience, the authors reach for the feeling of the wondrous and magical in the audience or readers. This is why many outstanding authors, and not only those who were inclined to romanticism (Gogol, Hoffmann, Chamisso, Edgar Poe, and Coleridge) but also rigorous realists (Balzac with his "La Peau de Chagrin", Thomas Mann with his "Doktor Faustus", Alexei Tolstoy with his "Aelita", Lion Feuchtwanger with his "Odysseus und die Schweine", Mikhail Bulgakov with his "Master and Margarita", etc.) revealed a penchant for the fantastic, not to mention the numerous fantastic plots, episodes, and characters in the works of such great poets as Shakespeare, Goethe, and Pushkin.

The feeling of the miraculous is, as a rule, inherent in the perception of music. In the words of Arthur Honegger "...there is a good deal of the magical, of the inexplicable, in music ... music contains something of the miraculous" (185, 79-80). We do not propose here to unravel the nature of the effect of music but will only indicate the significance for this effect of the anaxiomatization mechanism. W. Schrammek, who studied the sources and origins of music, came to the conclusion that the advent of wooden and bone wind instruments was traceable to a specific receptivity to strange and unusual sounds in man (245, 53). To extend this line of thought, however difficult one's childhood may be, it is tinted in magic colors; even the most ordinary objects and the entire world at first acquaintance seem unusual and therefore wonderful and miraculous.

Now let us extend this analysis of the psychological aspects of the wonderful and miraculous within the framework of the proposed mechanisms to another traditional problem of creativity, the comic effect which has been thoroughly and comprehensively described in the extensive literature on laughter, humor and wit.* We cannot list all the apparent causes of the comical effect. What is important, however, is that the same cause may result in quite opposite effects depending on the

* Thus A. N. Luk, a Soviet psychologist, and Koestler, a British philosopher who have both carried out a most exhaustive survey of the literature believe that wit and creative activities are controlled by the same psycho-physiological laws (32, 33).

attitude of the subject. Consequently, the most important conditions which contribute to the feeling of the comical are internal.

Two conditions must be met if the comical effect is to occur. Firstly, the event is one which (in the logic of the sequence of events or in the subject's experience) contradicts what is expected in this situation or does not suit it.* In other words, the first condition of the comical effect is devaluation of the accepted norms and conventions because the real events occur in defiance of them. Second, it arouses a feeling of superiority in the subject because neither himself nor his relations or friends are in this predicament;** in other words, the subject holds his own personality in higher esteem because of his physical prowess or character, well-being and secure position in the social environment and in the world of things. True, at a certain stage of cultural and intellectual development one can make oneself or one's relations and friends objects of laughter, but even so the awareness of one's ability to rise above personal feelings and show impartiality may also be a source of a feeling of superiority. As André Maurois said, it is easy to laugh at oneself when it is petty things that make one laugh and there are more significant features which one can admire in oneself.

The first condition without the second one can, of course, lead to a wide variety of responses such as puzzlement, sympathy, indignation but never a comical effect***. Furthermore, the feeling of superiority resulting not from devaluation but from success, prejudice or flattery, cannot lead to a comical effect.

* To forestall accusations of a biased selection of evidence, let us refer to examples given by other authors; a kid appearing on stage during a dramatic show (Herbert Spencer); dancing to a tune which the observer does not hear (Bergson); a fit of diarrhea suffered by an officer in front of a line of soldiers (Koestler).

** A. N. Luk is quite right when he speaks of the feeling of superiority as a possible pretext of comicality when somebody else has lapsed and one is aware of one's own intellectual and moral advantages (32, 151-154). We understand this feeling in a wider sense as including the feeling on the part of the subject of security and confidence that he cannot find himself or his relations and friends in this situation and believe that this is a necessary prerequisite of any comical effect.

*** It is also possible that a situation comical for some may lead in others to those responses evoked by the miraculous. Thus quaint plots which make an adult smile condescendingly precisely because he sees in them only a deviation from the norms and conventions may seem magical to a child because they are unusual. This possibility of diametrically opposite responses to the same objects probably led to the saying that there is but one step from the great to the ridiculous.

The question that naturally follows is: are these two factors described above independent of each other and is it mere coincidence of their arising together which results in the comical effect, or is there a significant, more profound inner link between them?

The direct cause of the feeling of superiority in a subject is undoubtedly a situation in which expected events, accepted norms and conventions, have been devalued; consequently both conditions are organically fused. True, the feeling of superiority may be prevented by the subject's inner states (sympathy, solidarity, sharing in the events the normal course of which has been disrupted, identification with the object in the comical situation, and ethics). If these factors are not present, however, then the devaluation which is regarded as the first condition for the comical effect immediately leads to the feeling of superiority, which is a form of overvaluation. All this suggests joint action of the anaxiomatization and hyperaxiomatization mechanisms. Consequently, in the comical phenomenon there is not merely a shift in evaluation, but possible increased evaluation arising as a result of devaluation.

The pleasure experienced by the subject from the feeling of superiority is expressed, depending on the intensity and the subject's education, as a smile or laughter. But these can, in turn, be used to express an evaluative attitude towards people and various phenomena in the real life, and even to create the desired attitude towards the subject and other people.

Indeed, it is generally acknowledged that derision is equivalent to devaluation of the significance usually attributed to that which is being derided; by laughter people often express their contempt of problems, difficulties, and danger, their independence and dignity. In this way difficulties, problems, dangers, and claims to be all-powerful are devalued. The most primitive forms of derision are various derogatory gestures and bad language (devaluation of the norms of civil behavior) which, however, cause a comical effect only in very undemanding and uncultivated people. At the other extreme is refined witticism, which is not comprehensible to everybody for it requires the ability to see rather subtle hints. Between the two are satirical sketches, puns, anecdotes, cartoons, etc. Using the forms of humor described above the narrator or performer creates, by verbal or artistic tools, a comic situation in which the effect only works if the two above conditions are fulfilled. Puns and witticisms are good if they contain unexpected turns

of phrase, combinations of words or consonances that have not been used or noticed. An anecdote is good if its end is unpredictable, i.e. when its plot deviates from the conventional train of thought.

These tools produce a comic effect thanks to devaluation not only of the traditional forms of expressing the idea or the usual development of the plot, as is the case with anecdotes or of the events predicted or suggested by the situation but, above all, of specific individuals and real phenomena. To put it differently, the devaluation achieved by these tools is double.

The feeling of superiority which authors of jokes and witticisms experience because they succeed in making their opponents look ridiculous is passed over to the audience who respond with laughter.

In our opinion, an analysis of the psychological nature of the comical makes it possible to understand how the subject may learn to control the inner mechanisms of mental activity. Clearly the earlier forms of the comical effect are those in which it is achieved through devaluation by reality itself. Repeated observations of real facts leads men to comprehend, even if only intuitively and not at all consciously, certain cause and effect relations between external events and certain inner states of mind. In this way a link is implicitly established between disruptions of the predicted course of events and the possibility of an associated positive experience, the feeling of superiority; but in this way the subject in effect discovers new sources of pleasure. Consequently, reality, actual events, train men in the use of the anaxiomatization mechanism, albeit first for purely hedonistic purposes. However, once the subject resorts to a tool for some purposes he learns to use it, sooner or later, for the most diverse purposes. More specifically, anaxiomatization also becomes a tool for jettisoning routine ways of handling tasks, irrelevant and misleading information or details, etc. The objective mechanisms which originally performed only one set of functions now successfully perform other, more significant ones. This seems to be one possible way of making the subject aware of the inner laws discussed here and enabling him to master them.

INDICATION
OF THE PROPOSED PHANTASY MECHANISMS
IN SCIENTIFIC LITERATURE

If the proposed mechanisms of anaxiomatization and hyper-axiomatization are so important, then one may logically expect other authors to notice them (at least some of their aspects) too. Indeed, many psychological and philosophical papers mention them explicitly as well as implicitly. Let us first consider formulations which imply the devaluation mechanism. Dugas wrote that in creative imagination "... we get rid of accessory details, we relieve ourselves of a welter of acquired knowledge, we jettison the ballast to insure our march forward" (143, 252). Another French psychologist, Burloud who analyzed and summarized the findings of the Würzburg school, mentions acceptance and rejection among mental activity mechanisms alongside thinking and estimation.

Spearman wrote of the need for "the disappearance" of some knowledge as "...vital for such operations as those of abstracting and conceiving". He also noted that "... expressiveness ... may be increased by eliminating irrelevant features" (252, 55). A similar idea regarding the analysis of puzzle solving is expressed by Dunker.

In his *Anthropological Significance of Phantasy* Hans Kunz devoted several chapters to negation as a specific human characteristic (199). Negation is said to act not only as a logical operation but also as a more general principle of psychological life (199, 42-47). Similar ideas have been recently expressed by Rouquette (239, 81).

In addition to associative processes, Bourne and Restle's mathematical model of concept formation incorporates the adaptation process, which results in the suppression of irrelevant "cues", which are ignored by the subject. L. S. Hearnshaw writes of "...the capacity to see the essential pattern of the whole and not be misled by details..." and "...an ability ... to ignore habitual solutions" (179, 59).

Characteristically, most of the authors of the papers in the collection "Creativity and Its Cultivation" edited by Anderson, call the reader's attention at some point to the role of a mechanism which to some degree amounts to anaxiomatization. Thus E. Sinnot believes that the most important unconscious processes in the function of creativity include rejection of "certain combinations as unimportant or incompatible..." (248, 25). C. Rogers writes: "The artist paints surfaces or textures

in simplified form, ignoring the minute variations which exist in reality. The scientist formulates a basic law of relationships, brushing aside all the particular events or circumstances which might conceal their naked beauty" (237, 77). Among other factors of creativity, H. Murray mentions a predisposition to the rejection of redundant knowledge (218).

A. Newell, J. C. Shaw, and H. A. Simon think that rejection of previously accepted ideas is required for the successful functioning of the thinking process (221, 65).

The interesting reasoning of D. Hebb about "rejection" of information makes it possible to draw a dividing line between our theory of phantasy and apparently kindred ideas. Hebb emphasized that "the true difficulty in such cases is to select the relevant facts and ideas, disregarding the rest" (180, 304). He attaches, however, a secondary importance to "disregarding" and "rejection" when he says that the nature of the creative process is in that one has to "... select the relevant facts, to create effective new ideas, and to get rid of the mistaken ideas of the past which were blinding the thinker" (180, 304). But in our view, "getting rid of mistaken ideas" is a *prerequisite* of the "creation of new ideas" rather than the *result* of the creative process.

Some authors expand the range of what is to be rejected to include past and even direct experience as well as irrelevant details. Luchins underlines that, in tackling the tasks, one should separate oneself from the past in which one acquired automatic habits and specific knowledge (207, 133). Ryle believes that a thinking person should completely, or almost completely, isolate himself from whatever the exogenous facts impose on him.

Four of the seven principles which Zharikov, a Soviet philosopher, believes to be employed in "optimizing scientific creativity" also clearly point to the need for devaluation. They are: freedom of scientific thought, contradiction, negation, and the so-called "principle of the tree" (104, 25-26).

These appreciations of the positive role played by rejection of information, and past experience in general, when tackling creative tasks have been taken from a wider context where they may seem marginal and accidental remarks. Thus Hebb's rejection of irrelevant data is seen to be a supplement of other, more significant conditions of creativity. This is why the work of Berlyne, a US psychologist, *Structure and Direction of Thinking* is especially interesting, for he devotes part of his book to rejection of inappropriate information in task tackling

(122). According to him, the basic mechanisms for this are attention, abstraction, and purposeful thinking. We doubt the adequacy of explaining this process in terms of traditional psychological concepts which themselves need explanation. But while disagreeing with the general theory that Berlyne has put forward, we warmly welcome his idea that in mental activity rejection of information is as important as its accumulation. In physiology Ralph N. Haber (172, 6 et seq.) has expressed similar ideas.

Those psychologists who see in a creative act a play of unconscious motives and associations emphasize disregard of the logical and real. According to them, genuinely creative activity is only possible through rejection of the logical principles and laws that are dictated by the specifics of objects in the real world and that handicap phantasy.

Back in 1932 Otto Rank, a psychoanalyst, wrote that the artist creates "almost in spite of [his experience]", which, according to him, imposes on the artist what is "transient" and hinders him from seeing what is eternal (232, 68-69).

The theories of Peter McKellar, which derive from psychoanalysis, posit the existence of two levels of mental activity: realistic which works by rejection of logically irrelevant assumptions, and autistic whereby logical rules and principles are disregarded. According to McKellar, this latter kind of thinking enables one to employ a much broader range of associative links which are otherwise kept dormant by logical principles (214, 185-187).

In all of these views expressed by psychologists, philosophers, and physiologists "rejection of information" is a *requirement* to be met by the thinker rather than an immanent inner mechanism (our interpretation of an axiomatization). This may be the reason why these authors see only the positive effect of "rejection", for there seems to be no point in observing rules which may lead to negative results. Thus Berlyne associates "rejection of information" only with directed thinking rather than with other kind of productive mental activity. However, even those psychologists such as Rank and McKellar, for whom rejection of logical rules and principles is a major prerequisite of creativity and who therefore could not ignore the negative effects of rejection (meaningless theories, incongruous concoctions, logical fallacies, etc.) could not overcome their one-sided interpretation of an important psychological mechanism which they had nevertheless to some extent perceived.

Consequently, one of the aspects of the psychological re-

gularity which is referred to here as the anaxiomatization mechanism has been more or less recognized in the writings of many researchers. As for the other assumed mechanism of phantasy, hyperaxiomatization, it will be shown to be to some degree akin to physiological and psychological mechanisms that have already been discovered, such as the dominance principle discovered by A. A. Ukhtomsky, the mechanism of functional fixedness explored by K. Dunker, and the feedback constraining mechanism described by N. Wiener.

The dominance principle was introduced by A. A. Ukhtomsky to explain apparently anomalous physiological reactions: stimulation of some nerve centers failed to invoke a response in the corresponding organs but led to the excitation of other centers and to inadequate responses.

The dominance principle, according to A. A. Ukhtomsky, acts "as a specific apparatus of coordination in the nervous system" and ensures "a stable vector of the animal's behavior within the entire diversity of the particular environment" (95, 131-132). Remarkably, Ukhtomsky himself noted both the positive and the negative effects of dominance. "In higher psychic life, the inertia of the dominant excitation, or the dominance of the current moment to be lived through may act as a source of 'prejudices', 'obsessive images', 'hallucinations' but it provides the scientist with the 'flywheel', 'the leading idea', or 'the basic hypothesis' which enables thought to proceed more smoothly and harmoniously and facilitates the connection of facts into one experience" (94, 170).

Consequently, Ukhtomsky's principle of dominance represents a fundamental law of the life activity of an organism; to be more precise, the principle of dominance expresses that concrete form of the stabilizing effect which can be detected through physiological methods of research. On the other hand, psychological techniques using semantic material reveal more subtle characteristic features of the stabilizing effect, mainly, preferences which are dynamic as well as stable. It is quite understandable that these psychological facts call for their own particular explanation and cannot be reduced to the prevalence of excitation in certain nervous centres.

Another theory which provides its own specific explanation of the stabilizing effect is Dunker's functional fixedness, which was analyzed in detail in Chapter II. Now we will look only at the difference between this theory and our treatment of the stabilizing mechanism.

Functional fixedness is viewed by many psychologists, espe-

cially of late, as being the result of a fairly stable association between an object and one of its functions; as a result it is difficult, if not impossible, to imagine that the object can perform other functions as well. Consequently, even though Dunker believed himself to be an adherent of the Gestaltpsychologie his functional fixedness is substantially closer to associationist views, in which the decisive significance is attributed to the past experience.

As shown in Chapter IV (third experimental series), it is precisely for this reason that Dunker's theory fails to explain preferences which arise in the course of mental activity. The hyperaxiomatization mechanism proposed in this Chapter as an explanation of this phenomenon differs from functional fixedness, first, in that it starts to operate immediately after the decision has been made and, second, it is essentially dynamic in that it can be short-lived. Dunker's theory, in contrast, represents only that aspect of the stabilizing function which is related with repeated exogenous action in the form of the same use of the object.

Dunker's narrow understanding of the stabilizing function is easily explainable. The preferences which are generated during mental activity itself can be noted through a comparison either of numerous solutions of an open task, or numerous attempts to handle a closed task; since Dunker confined himself to the latter and to an analysis of just one attempt to find a solution, he has succeeded only in detecting the "interference" caused by past experience.

Norbert Wiener, the founder of control engineering, also did not ignore the stabilizing function. In Chapter II we suggested that the feedback constraining mechanism which he described performs a certain stabilizing function in various spheres, including phantasy phenomena. In the light of experimental results and a theoretical analysis of various creative activities, this stabilizing function can be said to be performed by the hyperaxiomatization mechanism.

In our theory of phantasy, the hyperaxiomatization mechanism is regarded as complementary to the anxiomatization mechanism, which is not explicitly represented in the theories of Ukhtomsky, Dunker, and Wiener even though the prevalence of some reflexes and responses implies the suppression or rejection of others. In psychological literature, however, there is no suggestion of the possibility of a reverse dependence; indeed, many of the authors who in some way or other mention "rejection of information" fail to relate this to the stabilizing function.

True, references to the possibility of increased evaluation of some aspects of reality through devaluation of others are made in the works of two psychologically very observant writers, Lev Tolstoy and Lion Feuchtwanger.

Lev Tolstoy, speaking of the relationship between the ethical and the aesthetic, by which he meant refined or elegant, emphasized that "as soon as a man loses his moral sense he becomes especially sensitive to the aesthetic" (31, 317). In terms of our approach this dependence can be rephrased as follows: anaxiomatization of one approach (ethical) to the artistic task automatically results in hyperaxiomatization of the other (aesthetic).

In *Das Haus der Desdemona*, a critical study of the evolution of historical novels, Lion Feuchtwanger gives numerous examples of a natural combination of the writer's indifference to the historical material itself with extreme attention to various outward details of everyday life which often have nothing in common with basic literary concept (151, 184). These facts seem also to be interpretable in terms of the unity of both phantasy mechanisms, for neglect of the inner substance of historical events inevitably leads to an increased evaluation of the outward appearance of the events.

SUMMARY

The proposed theory of phantasy relies above all on the findings of experimental research described in the previous Chapter. However, to obtain a comprehensive evaluation and check of this theory, we found it necessary to analyze a vast body of data obtained by other researchers and facts from various spheres of creative activity.

The analysis of this additional data suggests that the proposed theory, far from being refuted by them, provides them with a rational explanation. Indeed, the psychological features of such artistic and scientific tools as analogy, tropes, symbols, and abstraction, and of some negative phenomena in productive activities (inadequate pictures, logical fallacies, and various irrational constructions) can be seen as the result of the operation of the proposed phantasy mechanisms of anaxiomatization and hyperaxiomatization. Researchers have fairly often come across facts which could have suggested to them new theoretical views, but unduly high evaluation of traditional opinions resulted in the devaluation of the new experimental data.

Consideration of specific forms of creative activity has revealed the diverse manifestations of both mechanisms. Depending on its nature and direction, anaxiomatization brings about different results. Thus disregard of quantitative and qualitative variations of objects enables us to establish an analogy between them; devaluation of the prevailing differences between phenomena, devaluation of differences between the genus and the species, the part and the whole, the animate and the inanimate, the substitute and the substituent, etc. is basic to the formation of tropes and symbols; neglect of details that are, in one respect or another, secondary, leads to the creation of schematic images; rejection of routine solutions encourages original ideas and discoveries; devaluation of insignificant (accidental) features is the technique used in abstraction and concept formation; devaluation of the ordinary, habitual produces the impression of something wonderful and "fantastic" and devaluation of the expected may serve as a source of humor.

Hyperaxiomatization also manifests itself in various ways: in the subject's confidence in his conjectures, in the extreme stability and longevity of generalizing concepts, in a certain "repetitiveness" of metaphors, in the charm of tropes, in the artistic power of symbols, in the feeling of the miraculous in the perception of extraordinary phenomena, and in the feeling of superiority caused by the comical effect.

Comparing our own views and those of other authors helps more precisely formulate our theory and make clear its distinction from other theoretical concepts.

The differences of our theory and other similar theoretical views on the subject are summarized in the Table.

Proposed theory	Other theories and formulations
<p>1. Anaxiomatization (devaluation) works in unity with hyperaxiomatization (overevaluation and the stabilizing function).</p> <p>2. Anaxiomatization is regarded as a <i>sine qua non</i> of new ideas, discoveries, etc.</p> <p>3. Anaxiomatization is an <i>objective internal mechanism</i> which invariably governs any productive activity.</p>	<p>1. Rejection of information is not related to the stabilizing function.</p> <p>2. Many authors regard rejection of information or past experience as an <i>additional</i>, auxiliary tool which is employed with other, more important techniques of mental activity.</p> <p>3. Rejection of information is a <i>requirement</i> made to the thinking subject which he does not necessarily meet.</p>

Proposed theory	Other theories and formulations
<p>4. The stabilizing effect is the outcome of a heightened evaluation of a successful, in the subject's view, way of performing a task, an evaluation which is generated <i>in the course of mental activity</i>.</p> <p>5. Hyperaxiomatization is dynamic.</p> <p>6. In the course of a productive activity, <i>evaluation</i> of information, ways of performing the task, etc. change.</p> <p>7. Both phantasy mechanisms may cause <i>positive</i>, as well as <i>negative phenomena</i>.</p>	<p>4. The stabilizing effect is explained by <i>past experience and multiple repetition</i> of the activity.</p> <p>5. The stabilizing function leads to effects <i>invariable over a long period of time</i>.</p> <p>6. The information, ways of performing the task, etc. are <i>themselves changed or rejected</i>.</p> <p>7. The tools and techniques of thinking lead either to <i>positive or to negative phenomena alone</i> (A. A. Ukhtomsky's dominance principle being an exception).</p>

Chapter VI

FACTORS CONDITIONING THE PROCESS OF PHANTASY

The modern science of psychology relies on a multitude of facts and figures as the source of information on factors that affect creativity in one way or another. We are mainly concerned with its motivations, the individual features of a personality, socio-psychological factors and age characteristics associated with the positive or negative results of the process of phantasy. Many psychologists do not go beyond the mere statement of these facts. They do not apply them as a touchstone to check the existing theories of productive mental activity. However, every psychological theory presupposes logical conclusions pertaining to the factors affecting the manner in which hypothetical laws reveal themselves. By juxtaposing the various factors that condition the process of phantasy with the conformable conclusions arising from our conception, we shall assume a special attitude toward the assessment of its validity. At the same time, the study of these factors will help us envisage the prerequisites for making practical recommendations indispensable for the development of a person's creative abilities and the optimization of creative activity.

MOTIVES OF PHANTASY

The early works on phantasy never focused directly on its motives; rather, they presented it as a cause of various psychological states. Thus, rationalists identified it with an essence actively opposed to reason. Phantasy was viewed as the primary source of feelings, emotions and aspiration, acts and deeds. James Tissot wrote: "It is imagination that inflames the passions by painting in a fascinating or terrible fashion an object which impresses us... It says to an egoist: In effect, you are yourself the only end of your activities, the world is made for you... It says to an arrogant man: Can you possibly tolerate that someone who

is not worthy of you is your equal or even superior to you?.. To an intemperate pleasure seeker, sensualist and debaucher it says: Life is but a dream, let us spend it merrily" (264, 32-33).

Contrary to that, certain psychologists, such as Lucien Arréat and L. Dugas, regarded emotions as psychic phenomena accompanying and even causing phantasy. Arréat noted that "the first and the only reason which compels a poet to write ... is the great pleasure which he experiences in doing so" (112, 133). Dugas, on the other hand, was basing himself on the premise that "emotional" and "imaginative" rhythms seem to accompany and supplement each other, and he noted that "it is a feeling that initiates imagination and controls it" (143, 125-26).

Thus, in contrast to the rationalists and their followers, who regarded senses as derivatives of phantasy, empirical psychologists held that the senses were one of its principal motives. This concerns a great variety of senses, such as love and hatred, joy and sorrow, elation and alarm, the sense of the beautiful, of the just, etc.

At present, psychologists have developed a more differentiated approach to the role of emotions as motives of creativity. In particular, this finds its expression in a desire to elucidate the senses that contribute to the positive results of creativity and those that affect it negatively. Creativity benefits from a number of so-called positive emotions associated with the feelings of accomplishment and satisfaction and pleasure. Moreover, mental activity becomes attractive when it promises pleasure. Since the time of Plato surprise has been regarded as a powerful motivation of all processes of cognition. Creativity is also influenced positively by such emotions as sympathy or compassion, desire to assist, etc. (179, 54). Contrary to that, fright, annoyance, embarrassment and other negative emotions suppress phantasy. Alex Osborn contended that permanent fear for their lives prevented scientists in nazi Germany from concentrating on scientific problems (223, 183).

Alongside the emotions, traditional psychological systems attributed a special place to will which was regarded as a power capable of controlling phantasy and, if need be, opposing the emotions. Thus, Dugas asserted that rational willpower organizes imagination as it were (143, 112). Theodor Elsenhans believed in a direct dependence between the productivity of the process of phantasy and the role played in it by conscious willpower (149, 37).

Special emphasis was placed on willpower in the views expressed by voluntarist psychologists who counterposed two

fundamentally different, in their opinion, varieties of phantasy: passive and active (creative). K. Heymann, in particular, points out that "creative phantasy is the expression of will" while "passive phantasy develops from memory" (183, 78).

The idealistic essence of voluntarism which negates the objective laws is most conspicuous; however, we regard as absolutely unacceptable surrealism, its antipode whose representatives maintain that the so-called "psychic automatism" is fully sufficient for successful creativity. If we follow the logic of those who propose absolute "non-interference" of consciousness in the spontaneous evolution of notions, we would have to accept dreams and all sorts of delirious inventions as the most creative processes (123, 111-112). Evidently, no solid creative product can result from such a complete "relaxation", for it presupposes an active organizing principle which has to be determined by the objective intrinsic laws of imagination.

The establishment of the fact that the process of phantasy is set into motion by emotions and willpower appeared to be an important landmark on the way toward elucidation of the motives of phantasy. Yet we have to admit that the notion of motive is interpreted differently in different psychological systems. Psychoanalysts and, especially, Gestaltpsychologists fell short of making strict distinction between the motive and the general laws of the process. On the other hand, we also find unacceptable the interpretation of the motive as an initial impulse, the "first push" (behaviorists). We completely disagree with the elimination of distinctions between the general laws and the motive, applying the term "motive of phantasy" to denote individual factors or their complexes which serve to encourage man's productive activity, maintain his desire to accomplish it, or even compel him to re-address himself to it from time to time.

In summing up the results of numerous investigators, Richard Crutchfield made an attempt at dividing the motives of creativity into external and internal. He attributed to the former a person's desire for material gain, such as money and promotion in his job, self-enhancement or self-defense, and to the latter, the intrinsic pleasure taken in the creative process, a solution and the aesthetic satisfaction of arriving at an "elegant" solution (138, 121-122). However, it would hardly be reasonable to draw a line between the internal and the external motives; S. L. Rubinstein has conclusively proved that all the external factors have to undergo a transformation through the internal. Therefore, it would be wrong to present, for instance, a desire for a material benefit as a purely external reason: different people (owing to individual

internal reasons) attribute different significance to the prospects of acquiring one and the same material benefit.*

With this clarification in mind, the so-called external motives may also conventionally include "the pressure of circumstances", presence of problematic situations, presentation of problems, etc. (119). Some foreign psychologists also attribute to the external motives of creativity competition, a desire to have the upper hand over one's colleagues and rivals, etc.

A much greater role is played by the internal motives (another conventional term) which are closely associated with the external factors and which manifest themselves especially explicitly owing to the latter. A drive for the preservation of balance in the psychic field, the so-called *concept of homeostasis*, appears to be the leading internal motive in the Gestaltpsychological system. Yet even among the advocates of Gestaltpsychologie we may find those who are quite right to criticize the "theory of balance" which endows man with a constant desire to expend as little of his mental energy as possible; the critics contend that in reality man seeks mental activity, progress and creativity. G. Allport resolutely opposed the homeostatic conception of motives, emphasizing that the personality system tends to upset the balance and preserve the state of tension. Frank Barron pointed out that the available experimental data offer serious challenge to the concept of homeostasis which posits a basic conservative tendency in organisms, reducing the need for counteraction (118, 80-81). Posing as a motive, essentially polar to homeostasis, is a drive for *informative novelty*, a thirst for new impressions (215, 60), and even for fabulous "imaginary creatures"—like angels and seraphs in the past, who allegedly inhabited the heavens, and, at present, for the inhabitants of distant galaxies.

According to psychoanalysis, phantasy is essentially motivated by ungratified actual aspirations which produce tensions in man's psyche and evoke reminiscences based on the impressions of his childhood. Freud and his orthodox followers explained the creativity of poets, artists and representatives of other arts by the desire to solve one or another personal problem, to alleviate the tension in their psyche, or to overcome some internal conflict which is, at the same time, characteristic of many people.

* Characteristically, some foreign authors place the level of motivation in direct dependence upon material gain. Glücksb erg, for example, associates a high level of motivation with a 10-dollar prize for the quickest solution of a problem; and finds a low level among the people who are merely asked to solve a problem (161, 85).

The critics of Freud's conceptions, including psychoanalysts, for example, G. Rose, disagree with the thesis which confines the motives of phantasy (and creativity) to a desire to reduce internal tension, and, in particular, to a desire for sexual gratification.

Certain authors regard the motive of phantasy as a desire to do away with every dependence, including that on the past, commonly known as infantile complexes; in other words, phantasy is not a retreat to the prime "experiences", or merely a camouflaged gratification of stifled aspirations, as Freud holds, but an active onward movement (211, 145-153).

All these ideas may comprise a conception according to which a desire for *self-expression* or for self-actualization (using the terminology of some authors) is the leading motive of creativity and phantasy. The advocates of the conception of "self-expression" discern a subject's active aspirations for asserting his personality and upholding his own self in almost all the manifestations of creativity; this trend is conspicuous even in variations on a basic theme which some psychologists interpret as the artist's desire to render reality as closely as possible to his own idea of it [Cf. Jaroslav Havelka (178, 139)]. "When we invented cubism," noted Pablo Picasso, "we had no intention of inventing cubism, but simply of expressing what was in us" (Quoted from 159, 51).

However, it would hardly be possible to object to the opinion according to which dissatisfaction is a vital motive of phantasy. Nikolai Chernyshevsky wrote years ago: "Phantasy captivates us whenever we experience destitution in reality. A person lying on a bare bunk is often day-dreaming about a gorgeous bed made of some unheard-of precious wood, about an eiderdown featherbed, about pillows trimmed with fanciful lace, about bed-curtains made of some amazing Lyons-woven fabric—but is it conceivable that all these things may be so greatly alluring to a healthy man who sleeps in a soft and comfortable bed, even though it is not extravagant?" (14, 49). Long before Freud, Chernyshevsky convincingly proved that it is dissatisfaction with one or another aspect of actual reality that motivates phantasy. Dissatisfaction may also emerge, René Boirel contends, from man's perpetual eagerness for clarity, simplicity, order and accomplishment (129).

One more aspect of dissatisfaction was profoundly exposed by Albert Einstein: "I believe first of all ... that one of the strongest motives leading to science and art is fleeing from the routine life with its tormenting cruelty and deplorable emptiness, from the fetters of our perpetually changing wishes" (146, 108). At the same time, man's involvement in the sphere of art and

science contributes to his self-assertion and the "self-actualization" of his entire creative potential. Thus the activities of one and the same person may be internally stimulated both by his dissatisfaction and his yearning for self-expression. This idea was most clearly expressed by Maxim Gorky who defined the roots of his desire to write: "Asked why I became a writer, I answer: the 'pangs of my destitution' were so strong and I was so full of impressions that I could not help writing" (18, 473). Consequently, both dissatisfaction and a desire for self-expression are extremely important as the factors motivating phantasy, although some psychologists regard these two factors as incompatible.

Alongside these two motives, psychological literature describes one more specific motive of "deviation" from reality, namely, a desire to create objects, images and ideas different from those existing in the particular situation. Dugas pointed out that preference and selection of a solution are often predetermined by some people's desire to challenge what exists and is universally accepted (143, 317-320). According to Albert Burloud, a tendency for opposition (counterposition), along with a tendency to create according to an analogy comprise the basic motives spontaneously inherent in human intellect. Highly illustrative of this motive is the following confession made by Boris Pasternak: "When I got to know Mayakovsky much better, I discovered a number of unexpected coincidences in technique, in conceiving images, in rhyming.... In order not to repeat him, nor to imitate him, I began to suppress in myself the trends resembling his... This narrowed my poetry and purified it" (44, 229). Some psychologists go even farther in discussing "a dispute" of phantasy with reality which may be found in original forms of fraudulence (249, 168) and of images.

Thus we have considered the most significant psychological motives of creativity. What psychological laws ensure their realization? In our opinion, the most important role in realizing these motives has to be attributed to the hypothetical mechanisms of phantasy—anaxiomatization and hyperaxiomatization.

Truly, dissatisfaction with various aspects of reality causes us, as we have seen, on the one hand, to neglect or devalue them (say, a retreat to the "unreal" or an escape "from the routine life"), and on the other hand, to make a heightened evaluation of objects which play a compensatory role (enormously high significance attached to imaginary objects, phenomena and persons, as well as idolization of science and art). The role of the anaxiomatization mechanism is especially conspicuous when phantasy is motivated by a "tendency for opposition" or a negative attitude

toward one or another phenomenon. In these situations a subject has to devalue the opinions expressed by his opponents, as well as by the people whom he does not want to resemble, and to anaxiomatize certain creative problem-solving techniques and methods and even certain aspects of reality.

At the same time, the realization of the motive of self-assertion, too, greatly depends on the two internal mechanisms of phantasy. Self-assertion, in the first place, involves a specific internal stability which is secured by the mechanism of hyperaxiomatization, while the assertion of personal views, ideas and creative principles may only be possible provided various stereotypes, prejudices and other obstructing factors have been overcome by their devaluation.

Thus, the two hypothetical internal mechanisms of mental activity, anaxiomatization and hyperaxiomatization, stand forth as relevant instruments which help realize the most essential motives of phantasy.

PERSONAL PECULIARITIES AND PHANTASY

The problem of the influence of various personal peculiarities and features on the results of the process of phantasy has long been the concern of psychologists, who have offered various different solutions. Some have defined the notions of creativity and originality on the basis of personal qualifications, thus making a distinction between creative and non-creative persons.

Yet, the opinion is widespread that all the people are capable of creative performance accomplishments. Calvin Taylor, in particular, maintained that "creativity occurs at practically all ages, in some aspects of all cultures, and to some degree in all fields of human work and endeavour" (258, 8). In this sense, the traditional question, "What are the characteristic features of a creative personality?", has to be replaced by the question, "What personal features contribute to the realization of the positive effects of the intrinsic laws of phantasy, and what features lead to the negative effects?"

We base this question on the assumption that the results of the process of phantasy may be considerably affected by the various influences (above all, educational) to which a person may be exposed. Conceding that a number of investigators whose materials have been applied to this study adhere to different methodological and theoretical positions, their experimental data provide us to some extent with an answer to the question we have raised.

A century ago Cesare Lombroso, in his notorious book *Genio e follia* (Genius and Insanity), made an attempt at placing genius and creative abilities in dependence upon various psychic disturbances. His views invariably invited much criticism; in particular, his critics contended that in many cases people of genius revealed their psychic disorders long after they had achieved their outstanding results, which utterly excludes the assumption that a disease is a reason for their creative accomplishments (257, 98). At the same time, extensive observations revealed the fact that certain personal peculiarities contributing to creativity may seem overly extravagant and eccentric to the majority of people.

Ye. G. Yakovlev made an observation that creative personalities are often characterized by "emotiveness of acts and deeds (cf. the scandals of Sergei Yesenin, Feodor Chaliapine's eccentricity, etc.)", as well as displays of excessive emotional excitement; suffice it to recall the fits of hysteria suffered by Leonid Andreyev, Arturo Toscanini, Edith Piaf, etc. (101, 10). Among the other peculiarities of such personalities we can single out their ability to show surprise at well-known facts and phenomena, their increased concentration and permanent interest in seemingly insignificant objects, extreme and almost childish naivety in many respects, their intractability, stubborn misunderstanding of seemingly simple verities and abstraction from "wordly" joys, sort of self-denial. Wilhelm Ostwald asserted that a researcher's success in many cases hinges on his "complete lack of respect for well-trodden paths" (224, 63).

Playfulness and eagerness to joke have long been ascribed to a creative person. This what Ivan Bunin wrote in his reminiscences about Anton Chekhov: "It takes a very wise person, such as that who has 'wisdom circulating in his veins', to invent and present a good absurdity or a good joke" (13, 492).

A. A. Malinovsky made a point of kindness as a personal peculiarity contributing to creative accomplishments, since "what we call kindness in moral aspect is extremely closely linked with the ability to assume another person's standpoint" (35, 288). In other words, kindness is regarded as a remedy against an excessively increased evaluation of one's own views obstructing scientific objectivity.

If we base ourselves on the assumption that everything original results from devaluation, we can realize the significance for successful creativity of such personal faculties as courage, readiness to be in conflict with one's opponents and even with close friends and relations whose views have to be subjected

to an axiomatization. Academician Kedrov pointed out that a scientist has above all to possess the following personal features: "resoluteness not to stop midway", "boldness at conceiving an idea" and "fortitude to oppose the stream and challenge what has been idolized by the majority" (23, 31).

The persons characterized by a creative approach are usually well aware of the difficulties they would have to encounter, and they willingly challenge them. Vincent van Gogh wrote on that score: "In things of art the saying is true: honesty is the best policy—rather more trouble on a serious study than a kind of chic to flatter the public. Sometimes in moments of worry I have longed for some of that chic, but thinking it over I say: no—let me be true to myself—and in a rough manner express severe, rough but true things. I shall not run after the amateurs and dealers, let those who want to come to me" (162, 146).

The latest studies have provided an extensive list of personal qualities, of which Erich Fromm has singled out the following: the capacity to be puzzled, the ability to concentrate, the ability to accept conflict and tension, the willingness "to be born every day" (154, 48-51, 53). Some authors add to this list the following qualities: intellectual curiosity and intellectual honesty, acceptance of responsibility for process and result, objectivity, criticalness, open-mindedness, conviction of universal cause-and-effect relationship, disposition to be systematic, flexibility, persistence and decisiveness (135, 38-39). Jerome Bruner discussed the readiness of creative persons to deny the obvious, their passion combined with the ability to abstain from premature conclusions (133, 12-15). Richard Crutchfield believes that a creative approach often requires a person's fresh, spontaneous, "childlike" mode of perception and ability to go beyond the stereotyped kind of reality (138, 124). Yet, by far, the most extensive list of qualities of a "creative" person has been offered by Florence Vidal (268, 123-134).

Along with the elucidation of the personal qualities indispensable for creativity it is equally essential to clarify the possibility of their compatibility; it would be quite reasonable to ask whether persistence and resoluteness hinder the development of such qualities as self-criticalness and perceptivity. Joy Paul Guilford was the first to make an attempt at elaborating the foundations of the compatibility and interdependence of qualities inherent in a creative personality. He proceeded from a highly complicated speculative premise that human intellect is made up of three essentially independent aspects: contents, operations, products. According to Guilford, intellect may contain imaginal, symbolic,

semantic and behavioral entities. Guilford classified as operations the cognitive functions, memory, convergent (algorithmicized) thinking, divergent (original) thinking and evaluation; and as products of thinking he termed units, classes, relationships, systems, transformations and implications.

Guilford followed C. Spearman, R. B. Cattell and H. Eysenck, etc. in proposing his own variant of the "factor" analysis of intellect, which enabled him to expose the correlation between the data of two tests, for example, the correlation between a measurable feature of the subject and his productivity in one or other sphere of activity.

As Donald MacKinnon noted, a number of psychologists were hopeful that Guilford's tests aimed at revealing creative abilities "would provide us with reliable means for the identification of creative persons" (209, 32). However, the researches conducted by MacKinnon himself, as well as by other authors, proved that these tests "fail to reveal the extent to which a person faced with a real life problem is likely to come up with solutions that are novel and adaptive" (209, 32). The practical fruitlessness of Guilford's tests was also denounced by Soviet investigators of creativity (103, 45).

Nevertheless, many foreign psychologists continue their researches into the factors of creativity in an attempt to reveal the character and personal features which are correlated with great creative achievements. Their experiments are essentially based on a division of all subjects into two groups: (a) those characterized by high results and (b) those characterized by low results in accomplishing tests for revealing creative abilities.

Several investigations conducted independently proved that "highly creative subjects" differ from "low creative subjects" in the number of questions they ask in connection with solving a problem or discussing problematic situations: the former are apt to ask much more questions and build much more associations both close and, mainly, remote. Sidney Parnes emphasized that the "non-creative problem-solver" gets an idea, sees it as a possible solution to his problem, and settles for it without further ado, while the creative problem-solver is not satisfied with his first idea in expectation of a better solution (225, 152). Carl Rogers discusses what is most important for creativity, namely, the "ability to toy with elements and concepts, ... the ability to play spontaneously with ideas, colors, shapes, relationships" (237, 76). Liebermann noted that children who reveal a greater inclination for "game behavior" display greater flexibility and originality, as well as express more ideas than the children

devoid of this inclination. W. Graham exposed greater creative achievements of the people who have specific "non-professional" hobbies. Ch. Schaefer discovered that many literary-gifted adolescents fancied their imaginary friends and life partners in their childhood.

Some psychologists maintain that along with "playfulness" creative persons are distinguished by their "disposition for complexity", i.e. they are inclined to give preference to complicated and asymmetric images whose construction does not comply with simple and obvious rules.

Frank Barron was the first to conduct a multi-faceted comparative investigation in the tastes and preferences of artists and "ordinary people". He established that the latter like relatively simple and bilaterally symmetrical and regularly predictable figures; these particular figures were described by the artists as "static", "dull", "uninteresting" (116, 182). The experimental data thus obtained were in many ways predetermined by the subjects' education, traditions, etc., yet Barron was absolutely right in attributing to tastes a person's specific qualities. According to the self-evaluation data, "ordinary" subjects are contented, gentle, conservative, patient, peaceable, serious, stable, timid, moderate, modest, responsible; as to the "artists", they are gloomy, pessimistic, dissatisfied, emotional and unstable (116, 189).

We have to note that it would be completely erroneous to look for a straightforward and direct dependence between various personal features and creative accomplishments. Naturally, we are dealing with extremely complicated dependences here, which may be defined only as general tendencies; thus we may concede that a subject who shows preference for more complicated deductions and a bent for mistrust and mockery, is more apt to anaxiomatize the deep-rooted prejudice than a self-complacent subject who seeks tranquillity and who is afraid to sidestep the canons, etc. However, this does not imply that "a well-balanced" subject will fail to reveal a creative approach if required of him. And the "mocking person" will, probably, be sceptical about such an approach instead of discarding the canonized ways of solution.

We have already noted the importance for creativity of such a quality as intellectual independence. Experimental data confirm these observations Kenneth Harwood who compared two groups of young scientists characterized by "high" and "low" creative results found that the former displayed considerable self-assurance and the ability to oppose "social pressure", while the latter were often observed with a desire to make a good impression

on the people around them and to gain their disposition. Similar results were obtained by Ellis Torrance and Dean Dauw in examining high-school students. Indian psychologist R. P. Bhattacharya discovered that young people with inadequate abilities tend to show dependence while gifted students are distinguished by independence and a bent for "autonomy". Sh. Kashdan and G. S. Welsh in making a comparison of high-school students with "high" and "low" creative abilities had to note that, while the former were characterized by a high degree of "non-conformism", the latter strove for success and external approval. These personal features also show in the selection of occupations and tasks; Torrance and Dauw, for example, emphasize that students with higher creative results are interested in unusual professions which presuppose creative originality.

Independence of mental activity has its antipode, conformity.* The first investigations into this problem were made by Solomon Asch who proved that certain people could be coerced by the majority to accept beliefs conflicting with what their own perception prompts them; meanwhile there are others who do not yield to the "pressure" of the group and preserve independence of judgement. This behavioral distinction serves to divide all persons into conformists and non-conformists.

Although some of Asch's theoretical conclusions, as well as the method for staging some experiments aimed at revealing conformity appear controversial, the very phenomenon of behavioral conformity is unquestionable, and its various aspects are being widely studied by psychologists both in the Soviet Union and abroad (15).

Richard Crutchfield suggests that a distinction be made between genuine conformity produced through a weakened conviction of the subject about his judgment and a readiness to assume that the group is right and he is wrong, and "expedient" conformity when the subject chooses deliberately to express outward agreement with the group, even though his inner judgment remains uninfluenced (138, 126). Crutchfield discerns in conformity a person's inner faculty which hampers greatly his correct comprehension and judgment of reality, and thus has a "fatal" impact on creative thinking. A person

* Foreign psychologists use the terms "conformism" and "conformity" as synonyms. V. Chudnovsky made a correct observation by pointing out that Soviet psychologists reveal a trend to "draw a clear distinction between the term "conformity", which serves to denote the respective peculiarities of the person's behavior subjected to psychological investigation, and the term "conformism", as a social phenomenon" (15, 165).

characterized by conformity is unsure about his "adequateness", he fears instability and seeks support in the group accepting their judgment non-critically and strictly adhering to their principles. Finally, he experiences a feeling of alarm whenever he had to show a creative approach which seems to threaten the stability of his existence.*

Polish psychologist Jaroslaw Rudniatski offers the following three basic reasons for behavioral conformity: the longing for tranquillity and security, the desire to be true to the group, and great susceptibility to the influence of the group resulting from mistrust of one's own thinking (240, 139-140).

What kind of relationship exists between behavioral conformity and creative activity? According to the data obtained by Crutchfield who tested scientific workers involved in industrial production, the more original scientists are the "less conforming" (138, 134).

It would be quite logical to presume that creative persons, in contrast to "ordinary" persons, are more apt to resist commonly accepted dogmata, conflict with other people and take risks. Experimental data fully support this presumption. Dutch psychologist van der Meer came to the conclusion that the individuals inclined to take risk, show a greater flexibility of thought and broadness of view than cautious and circumspect people.

On the other hand, we may presume that anxiety as a characteristic feature hinders creativity. The available data concerning this are controversial. Kinnard White, for example, asserts that "persons with relatively low levels of anxiety perform significantly better on divergent thinking tasks than persons with high levels of anxiety" (276, 127), while Irvin Flescher denies the presence of such correlations (152, 164). Hopefully, further investigations will clarify this problem.

Up to now, we have been concerned with investigations which establish correlation between specific features of the character and successful creativity; however, certain experiments have revealed the absence of such correlation. Thus, John

* We may, naturally, come across the other extremity: cases in which a person resists group pressure which may not be qualified as true independence of thinking, but this is a form of his reaction against the group since in this case a person is also susceptible to group pressure but "in a contrary direction" (138, 126). The striving for "difference for difference's sake" and the disposition for eccentricity and violation of unquestionable and elementary laws of logic, as well as other forms of negativism qualified as the "Bohemian mode" are often directed at the mere superficial outer appearances of the creative acts with a resultant loss of sensitivity to true creative merits (138, 126-137).

Casey did not discover any marked difference in the ability to solve social problems between "more creative" and "less creative" subjects, while the results of the experiments conducted by J. M. Eisenstadt failed to support the hypothesis that "creative individuals" showed a more differentiated response to an emergency.

In this respect, an especially thorough investigation was made into the relationship between creativity and intellect. Although a certain direct dependence was seemingly discernible between them, some doubts were expressed on that account as early as the 1930s. Frank Andrews, for example, focused his attention on the fact that even though the children with well-developed phantasy achieved high results in IQ tests, not all of them were endowed with creative abilities. L. Greenberg noted in his work that IQ tests offer a very limited indication of giftedness and do not make it possible to identify "genuinely creative persons".

The view of the principal distinction between creative abilities and the intellect was most explicitly presented by M. Wallach and N. Kogan in their monograph *Modes of Thinking in Young Children: A Study of the Creativity-Intelligence Distinction*. This was followed by numerous experimental studies which produced results indicating a low level of correlation (or its complete absence) between data characterizing the intellect and those characterizing creative abilities (182). In summarizing the data from a great number of experiments including his own MacKinnon wrote: "It simply is not true that the more intelligent person is necessarily the more creative one. I do not wish to imply that the quantity and quality of intellective processes are irrelevant to creative performance. Obviously, they are of the greatest importance; but alone and in the absence of other traits and dispositions they will not make for creativity, nor will mere intelligence identify creative potential or predict creative performance" (209, 33).

As is well known, Alfred Binet presented the intellect as a person's ability to understand the direction of his thought, to preserve the intellectual set and to correct his own logical fallacies (126). Since IQ tests are usually compiled on the basis of such a limited interpretation of the intellect, they, naturally, can only reveal, at best, individual aspects of mental activity, and precisely those in which creative activity is expressed least of all. Soviet psychologists frequently offered well-founded and multi-faceted criticism of the class orientation of these tests in organizing education in capitalist countries [B. M. Tep-

lov (90), N. S. Leites (29)]. It would be important to note that the answers which were accepted as correct during IQ tests had to meet earlier established criteria, while genuine creativity suggests the ability to find not only original answers but new criteria; this was also ignored in IQ test procedures.

We also have to take into consideration the fact that country-wide IQ tests can entail unfavorable consequences. This was quite justly noticed by D. Gvishiani, S. Mikulinsky, and M. Yaroshevsky who emphasized that the IQ tests "cultivate the adaptation of the intellect to the standard techniques which the subjects have to submit to. In other words, they cultivate conformism, non-originality and a desire to adhere to an imposed pattern" (22, 14).

What qualities do the people who displayed high creative result in the experiments ascribe to themselves? Judging by the data provided by J. Feldhusen and T. Denny, creative persons are apt to think much of their own abilities, this aptitude being noticeable even in children. According to Ch. E. Shaefer, "creative" adolescents believe that they are characterized by an urge for the complicated, for the new, for independence and self-assertion, Ye. Z. Mirskaya, a Soviet investigator into the history of scientific creativity, quite reasonably emphasized that a genuine scientist "has to feel like a scientist and possess the self-consciousness of a scientist" (38, 9). In summing up the extensive and diverse experimental material Donald Pelz and Frank Andrews arrived at the conclusion that the scientist's reliance "on inner sources (their own ideas)" has vital significance for scientific creativity (227, 109).

We have already noticed that one of the most essential motives of phantasy is a drive for self-assertion and self-actualization. One may believe that the above-mentioned high (in fact, exaggerated) self-evaluation of the abilities, opportunities and ideas of creative personalities is produced by the mechanism of hyperaxiomatization which thus ensures stable orientation of productive mental activity, which is extremely important in a struggle for self-assertion.

We would like to reiterate the idea expressed at the beginning of this Chapter that in using in this work data provided by other authors and in conventionally using their terminology (creative and non-creative persons), we do not contend that there is a sharp and rigid borderline which allegedly divides all the people into groups in accordance with their creative abilities. It is universally known that a person who poses as a "mediocrity" in one respect, for example, in the sphere of

technology, may achieve great creative results in some other sphere, say, in literature. Therefore, we have to conclude that it is senseless to speak of creative personality in general.

In considering the factual material we sought to prove that the personal peculiarities and faculties which are correlated with high creative achievements (for example, independence, courage) are "meant" to devalue unfounded dogmatic deductions, routine ways of problem-solving, etc. Therefore, data pertaining to personal peculiarities contributing to creative activities confirm our conception of phantasy according to which an axiomatization (devaluation) is one of the internal mechanisms of intellectual acts.

We attribute much significance to the fact that qualities ascribed to creative persons (except probably what is usually known as playfulness) cannot be rationally integrated with other conceptions of productive mental acts. While we can of course find a natural and real dependence between, say, such a personal feature as non-conformity and an axiomatization of commonly-accepted ideas, it would be absolutely impossible to establish any logical connection between this quality and such explanatory notions as "improvement of the dynamic structure of the psychic", analogy or actualization of the archetype, etc.

Meanwhile, the faculty termed "playfulness" is, at first sight, logically compatible with the behaviorist trial-and-error hypothesis: no doubt, "playfulness" enhances manipulatory acts and increases the number of tried variants. However, the problem of "playfulness" can be introduced into a different theoretical context. In studying the factors affecting the process of phantasy V. Romenets came to the conclusion that a person involved in a game is "liberated from his bonds by the field of perception" and that the game ensures relatively "independent attitude toward reality" (54, 4). Thus, in "playfulness" we may discover a person's desire to broaden his intellectual horizon by devaluating the narrowing limitations. The game situations allow for the neglect of various real situations. Therefore, the person's urge for the game situations preconditions the devaluation which may eventually produce a creative result.

THE SOCIO-PSYCHOLOGICAL FACTORS OF THE PROCESS OF PHANTASY

We have established that the orientation and character of creativity are predetermined by such psychological factors as motives and the person's individual peculiarities. Consideration

of these factors has brought us close to certain social problems of creativity. By and large, the requirements for and other motives of a person's behavior take shape and develop under the influence of social conditions. We may allude, for example, to the phenomenon of behavioral conformity which plays, as was proven, the negative role in creativity. Such behavior is the result of both the individual peculiarities of the person and of the relationships existing between persons in a creative group, moreover, of the peculiarities of social medium in the broad sense of the word. Therefore, the elaboration of the socio-psychological problems of creativity assumes extremely high significance. In relying on the basic problem of this investigation—the revelation of the intrinsic laws of phantasy, we will focus, mainly, on the results of the socio-psychological studies of creativity we find in literature, which, in our opinion, enable us to examine this key issue more extensively.

Some of the social aspects of creativity have long been the subject of close attention by writers and critics, i.e. the people who are professionally involved in creativity and whose experience has provided them with the knowledge of society's attitude towards them as creative persons. It is common knowledge that the life style of many original thinkers was often hard and even tragic under the conditions of antagonistic class society. This explains why social environment is usually presented in a number of fiction and philosophico-critical works as a hostile force directed against creative persons. The hostile attitude of bourgeois society toward manifestations of creative abilities found its vivid reflection in the words of the main hero of Diderot's *Le Neveu de Rameau* (Rameau's Nephew) who declared cynically: "Geniuses are aversive; and whenever a child is born with characteristic signs of this dangerous gift in its forehead, it has to be strangled to death or thrown away to be eaten by dogs."

At the beginning of the 20th century, French psychologist Edouard Le Roy was discussing the difficulties confronted by inventors and innovators in general in capitalist society, pointing out that they were often regarded as mindless and dangerous members of society (201, 197-198). The attitude of the overwhelming mass of society, i.e. "non-creative persons", toward innovations and discoveries was discussed in detail in the book *El hombre mediocre* (Mediocrity) by Jose Ingenieros. The psychology of mediocre people, Ingenieros contends, is characterized by their "inability to perceive perfection and to create the ideal", routine thinking and a desire to adapt "their

character to habitual conventionalities" (188, 55). At the same time, Ingenieros tries to determine the positive role of mediocrities which he reduces to consolidating and strengthening what has earlier been achieved by other "creative" persons and "geniuses" who once also had to wage a bitter struggle against similar mediocrities (188, 49).

By admitting in general terms the hostility of bourgeois society (of "mediocrities") toward gifted persons, Ingenieros is also justifying this attitude, characterizing it as conservative, hence useful for society.

In recent studies we may also find an extensive list of "social interferences" confronted by creativity in bourgeois society. In this respect, of special interest are the data provided by foreign psychologists themselves.* Bernard Thorsell wrote about the social forces counterposing creativity, and he showed convincingly that "the ability to doubt and to think creatively is very likely to appear as a disturbing and perhaps frightening trait, especially to those who lack the cognitive and/or social flexibility necessary for a tolerance of it" (262, 80). German psychologist K. Heymann believes that creative phantasy is damaged mostly by technicism in the form of multitudes of modern stereotype films, standardized TV programs, advertisements, etc. (183). Alex Osborn insists that urban life is extremely deleterious for the development of creative imagination, for it tends to suppress man's nature and intimacy (223, 45). Lawrence Kubie names the informational overload among the factors which block creativity (198, 37-38). According to A. Luchins, "factors that may discourage creativity are the growing mechanisation of industry and the specialization and division of labour that have reduced into routine, repetitive tasks many activities that once called for ingenuity and skill" (207, 138).

Guilford distinguishes the following four planes in which a struggle is waged against new ideas in capitalist society: (1) older scientists resist the ideas of younger scientists; (2) high-ranking scientists resist the ideas of low-ranking scientists; (3) rival schools of thought resist one other (along with rejecting

* It is important to note that not a single author of those we are referring to in this work speaks directly about the dependence of these "social interferences" of creativity on the concrete social formation under which the corresponding data were obtained; moreover, all of these authors tend to consider the provisions postulated by them as universal laws. Such an extrapolation of the peculiarities of the capitalist formation upon the other socio-political systems is not supported either by facts or logic.

new ideas); (4) members of one area of specialization look with suspicion upon the ideas of outsiders (170, 447-448).

Rogers depicts bourgeois society as contributing to the edification of the individual in the spirit of behavioral conformity; according to Rogers, both school and traditional education tend to turn out conformists.* In leisure-time activities, passive entertainment and regimented group action, which are overwhelmingly predominant, serve the same purpose. In the sciences there is an ample supply of technicians, but the number of those who can creatively formulate fruitful hypotheses and theories is small indeed, and even in individual and family life to be original or different is felt to be "dangerous" (237, 69-70). In commenting on that, Sidney Parnes maintains that the whole of modern bourgeois culture serves to adapt man to conventionalism, i.e. to conventional standards (225, 134). Maslow made an ironical observation, according to which especially valuable in today's science are caution, accuracy, procrastination and the ability to avoid errors rather than courage and audacity.

All of these psychologists emphasized the need to create the prerequisites for the struggle against all forms of social suppression of creativity. One of these prerequisites, in their opinion, would be freedom of the "creative person". Rogers, for instance, mentions "psychological freedom" (237, 80); Luchins speaks about the "freedom of actions and decision-making" (207, 132); Henry Eyring emphasizes the need for freedom from distraction and from an authoritarian society which prevents unbiased inquiry (150, 4); A. Wenkart interprets freedom psychoanalytically, i.e. as freedom from complexes constraining man's ego, etc. It is noteworthy that the authors we have mentioned completely ignore not only the political freedom issue which may eventually create all the prerequisites for truly creative activity, but also the need to change the social system presupposing, as was indicated by bourgeois psychologists themselves, a great variety of "social interferences" to creativity.

At present, we may often come across the collective character of creativity. Remarkably, even though creative problems are solved by individuals, the latter, nonetheless, are linked with social environment, their behavior is usually motivated by the

* Using extensive factual material R. Eisenman proved that the system of bourgeois education is not meant to reveal the creative abilities of students; on the contrary, it stands in the way of those who, one way or another, deviate from the conventional standards.

requirements emerging in this medium, they depend on the values and the relationships existing in this medium, and their creativity has been prepared by a great number of preceding generations (132, 267).

Some time ago Jean Piaget very accurately characterized the immediate favorable effect which interpersonal communication has on the process of phantasy: "We are constantly hatching an enormous number of false ideas, concepts, utopias, mystical explanations, superstitious, and megalomaniac phantasies—which disappear when brought into contact with other people" (Quoted from 214, 168).

However, contacts with other people not only help us get rid of the negative products of the process of phantasy specified by Piaget, but they also provide the foundation for the activities of special social formations—the so-called creative small groups which S. Mikulinsky and M. Yaroshevsky interpret as "the original subject of scientific activity" (37, 17).

A number of psychologists assert that the creativity of small groups and collective creativity in general have great advantages over individual creativity. Thus, Gordon, the creator of synectics, categorically stated that in thinking, a properly operating group has advantages over an individual (166, 10). Frank Restle and James Davis speak about "pooling of contributions" as a theory developed to describe the superiority of groups over individuals to solving word puzzles (235, 61). Guy Aznar and Florence Vidal maintain that a group mobilizes the creative power of its members thus helping them overcome all sorts of apprehensions and augmenting the volume of information and the number of different approaches (114, 91-100; 268, 145-153).

However, would it be reasonable to assert that in accomplishing any creative act a group, irrespective of its composition and the relationships of its members, always has unquestionable advantages over an individual? Obviously right are those psychologists who discuss not the advantages of the group over the individual in general, but the possible advantages of a group provided its activities are properly coordinated [B. Frolov (16, 279)].

The correct organisation of group creative activities presupposes the solution of a great number of problems. Among these special significance is attributed to the following: the requirements that have to be met by the qualitative composition of the group, the number of members that a group should include, the criteria determining responsibility distribution among the members of the group, the form that has to be

chosen to evaluate the activity of the group as a whole and of its members in particular and the selection of group leadership. It would hardly be possible to give direct answers to all these questions since both the creative groups and the problems solved by them are characterized by infinite diversity. However, the experimental data obtained by various authors make it possible to outline some of the general psychological principles for a more rational organization of creative groups.

In touching upon the problem of the optimal composition of creative groups almost all the authors are unanimous in the conviction that such groups have to be small. L. Hearnshaw emphasizes that on the basis of his experiments he has established that groups are superior to individuals, but large groups are not superior to small groups (179, 56). Restle and Davis arrived at a similar conclusion having summarized the results of many investigations (235, 41, et seq.). Some authors made an attempt at determining exactly the size of a creative group. Thus, Osborn believes that the ideal creative group should comprise from five to ten members (223, 87); Aznar, five to six members (114, 98) and Base, seven to twelve members (cit. from 216).

The problem of the *qualitative* composition of a creative group is, essentially, reduced to the question whether the group has to be homogeneous or heterogeneous from the standpoint of, first, the creative orientation of its members and, second, their creative capacities.

Even the early investigators of the problem of group creativity, such as Slosson and Downey, adhere to the opinion that whenever a group includes persons distinguishable from the bulk of the group by their personal qualities and creative orientation, it has a positive effect on the products of group creativity (249, 57). A number of authors pointed to the expediency of including in creative groups people with different modes of thinking. Osborn and, especially, his French followers emphasized the desirability of the "collision of opinions" which, they maintain, contributes favorably to the emergence of new ideas [Besse (124, 41), Aznar (114, 100)]. In summing up the results of a number of investigations Guilford was categorical about the need for competition (contest, rivalry) in a small group (170, 446). On the other hand, Middleton believes that a group experiences ageing as a result of long cooperation when people become less critical of one another. It is quite clear that we are dealing with the expediency of a purely *intellectual* rivalry, with *intellectual* "antagonism" between the

members of small groups; meanwhile conflicts occurring between the members of a group may interfere with creative activities [I. Leiman (28), Aznar (114), Vidal (268)]. Leiman, in particular, points out: "Concrete analysis proves that the 'simplest' conflicts in a group lead to a sharp reduction of efficiency and sometimes they fully eliminate every opportunity for creativity" (28, 267).

As to the composition of a small group from the point of view of the level of capabilities of its members, we have to admit that homogeneous groups, obviously, surpass heterogeneous ones. Thus, E. Torrance who conducted experimental studies of collective creativity of schoolchildren showed that the groups composed of children with sharply differing intellectual capacities more often revealed the signs of psychological stress: less capable children were overwhelmed by more capable children, the latter being apprehensive that they might fail their group since they (the latter) believed that something extraordinary was expected of them. Meanwhile in homogeneous groups the atmosphere was much calmer, all the participants realizing that they could compete on equal terms, which made them feel sure of themselves.

The distribution of problems among the small group has to be considered most rational when each member of the group realizes that his creative abilities and skills are taken into account, appreciated and utilized to produce the maximum effect. At the same time, the *individual* peculiarities of the members of a small group may not be neglected and each member has to operate with the optimal rate. For example, N. Israeli who studied various creative groups (artists and critics) arrived at the conclusion that increase in the rate of work stimulates only the most "competent" members and has a detrimental effect on the rest of the group.

The activity of each member of a creative group has to be evaluated objectively and in good time. For example, judgments concerning intermediate variants, the ideas which have not been fully thought out or preliminary solutions must be withheld. Special emphasis has to be placed on the form of appreciation. The data of the comparative experimental investigation prove that the best effect is achieved by the evaluations expressed as wishes and suggestions rather than the evaluations pointing to drawbacks and errors (170, 446).

In a creative group an extremely important role is attributed to the leader. The leader's personality, his capabilities and competence, his creative orientation and his relationship with

the members of the small group he controls greatly determine its psychological atmosphere and creative productivity [D. Taylor (259, 120)].

The leader of a creative group, as well as any other leader, naturally, has to meet a great number of requirements. It is far from sufficient for the leader to be competent in one or another field; he has to possess such features as authority, sense of responsibility, justice, objectiveness, tactfulness.

Lenin insisted that a leader "must possess a high degree of personal appeal" (5, 600). The personality of a leader has an immediate effect on the atmosphere in the group and on the relations between the members of the group. Each leader should be capable of finding the form of leadership that would both comply with the problems standing before the group and agree with the psychological peculiarities of its members.

In summing up the results of investigations of collective creative activities, we may offer an approximate characteristic of a successfully functioning small creative group (it goes without saying that numerous socio-psychological problems of collective creativity still call for fundamental study).

The creative group should have a limited strength (not more than ten or twelve people) and it should be composed of psychologically compatible members with relatively equal abilities, yet inclined to take different approaches to creative problems. Each member of the group should be absolutely convinced that his participation in creative activity presupposes utmost utilization of his skills and creative capacities. The rate of work of a creative group has to be determined by the individual capacities of its members. The evaluation of results should be tactful and benevolent. The leader should show a businesslike approach and possess certain personal features.

Thus we have considered some of the socio-psychological prerequisites determining creativity. There have never been any attempts made to compare these data with the existing conceptions of productive mental activity. In our opinion, it would be impossible to explain either the favorable or the unfavorable effects of all the socio-psychological factors on successful creativity by the positions of behaviorism, Gestalt-psychologie and other conceptions. For instance, why does a trend for conventionalism hinder analysis and synthesis, improvement of psychological structures, etc.? And why does a minor increase of the numerical strength of creative groups lead to the reduction of the number of variants selected on the trial-and-error basis?

Let us consider how the data presented in this chapter agree with the proposed conception of phantasy. We could see that the most essential obstacles "blocking" creativity in capitalist society are its conservative tendencies which find their expression in its contempt of innovation, in its standardization of life style, its disposition for conventionalism and hostility toward the people who deviate from the established mode of thinking. Quite understandably these conservative tendencies have to lead to a devaluation of original ideas, new approaches to the solutions of any problem and, at the same time, heightened evaluation of the established verities. In other words, the social circumstances we have mentioned precondition the orientation of anaxiomatization which produces only negative effects.

We believe that our conception of phantasy also explains the social factors promoting creativity. As we have already mentioned, the advantages of group creativity over individual creativity were explained by certain psychologists as a purely mechanical "pooling of individual contributions". This explanation runs counter to the unquestionable fact that the advantage may be enjoyed only by small groups (yet the greater the group, the greater should be the "pooling of contributions"). In our opinion, group activities ensure more favorable conditions for anaxiomatizing old-fashioned or unfounded ideas, since it is much easier to devalue someone else's views and opinions than one's own. This explanation is supported by the fact that the most productive creative groups are those composed of the people who favor different stratagems and approaches to problems, i.e. who are particularly disposed towards "mutual" anaxiomatization of views and opinions. However, in compliance with our conception of phantasy, creation of the new is inseparably linked with the second internal, mechanism, hyperaxiomatization. Obviously, the groups the numerical strength of which exceeds a certain limit will confront enormous difficulties and even may fail in achieving the necessary stabilizing effect, which, in our opinion, stipulates the necessity of forming relatively small groups, recommended as optimal for the most productive creativity.

THE PROCESS OF PHANTASY AND AGE

The influence of age on the peculiarities of the process of phantasy evokes both theoretical and practical interest. Investigators of this problem, above all, seek to answer the following questions: how does life experience and general development

of personality affect the process of phantasy? how does man's age determine his creative capacities? what family peculiarities promote the development of personal faculties contributing to creativity? how does education influence the process of phantasy? how does one or another course of training affect the character of the products of phantasy?

Proceeding from the main traditional theoretical conceptions of phantasy considered in Chapter II, two controversial answers to the first of these questions can logically be provided. According to the idealistic conception which interprets phantasy as a primordial creative power, certain philosophers and psychologists regard life and training as factors which either suppress or subdue this creative power. Plato is known to have asserted that experience takes away more than it adds, and that young people are "nearer" to ideas than old people. From the standpoint of this theoretical position a personality becomes less creative in the course of his development. This opinion was most consistently rendered by Harold Anderson who maintained that "creativity was in each of us as a small child. In children creativity is a universal. Among adults it is almost non-existent" (107, XII).

The opinion that along with age and while accumulating knowledge and skills a person's creativity decreases has even been supported by experimental data. Most striking results were described by V. Papanek. In his investigations he proceeded from finding out how many truly creative persons there were among 45-year-olds. He established that among the people who had undergone his tests, only two per cent could be considered as highly creative persons. Then he conducted tests with younger and younger people. Yet, his results revealed the same 2 per cent level. A marked augmentation of this percentage was recorded when he experimented with 7-year-old children of whom 10 per cent were characterized by creativity, while this percentage rose to the level of 90 per cent with 5-year-old children.

The available experimental data, however, are often controversial. The experiments staged by N. Trowbridge and D. Charles were based on the evaluation of drawings made by the children from 3 to 18 years old. One of the main conclusions made by the investigators was as follows: technical competence of the subjects increases parallel with their age. However, the level of manifestation of creativity in children from 3 to 15 years old is practically the same, yet it increases dramatically beginning from the age of 15.

The extreme idealistic interpretation of phantasy as autonomous creative power is counterposed by the extreme mechanistic view according to which phantasy is a product of imitation. Lucien Arréat who conducted his studies in the 19th century was, for instance, absolutely convinced that creativity originated from imitation which he regarded as a school of creativity and as an exercise of phantasy (112, 121). At present, analogous views are expressed by certain French psychologists including Philippe Malrieu who regarded imitation as the indispensable prerequisite of imagination (211, 113).

In Chapter II we demonstrated the impossibility of explaining phantasy by means of imitation. Now we will dwell on the genetic aspect of the role of imitation. There is no doubt that a person accumulates much knowledge and many skills through imitation: this holds for mastering speech and writing, and acquiring intellectual habits and social experience. Moreover, man uses everything he has acquired through imitation one way or another while accomplishing creative acts, too. However, would it be reasonable to assert that phantasy (which we interpret as productive mental activity) derives from imitation? In order to answer this question we have to address ourselves to the available data pertaining to manifestations of phantasy in very young children.

The advocates of the conception of imitation usually refer to this commonly known observation: a child endows the object of his game with the properties of the objects which he has seen and which have impressed him. Thus, he "turns" a stick into a horse, chair into a locomotive, and he himself becomes a horseman, an engine-driver, etc. This allegedly suggests that the child's phantasy is characterized by imitation [Jules Jean Biervliet (125, 129)]. Certainly, both the *material* used for the game and, to some extent, the game's plot are borrowed from the reality with which a child is making acquaintance; yet the result of the process of phantasy in this case is not the game itself but its basic prerequisite: the *identification* of objects completely different both by their look and in essence. It is in the identification of multifarious objects that the child's phantasy displays itself; yet in doing all that, a child is *not imitating*, for he has no one to imitate since no adult acts in this way: to them a stick never plays the role of a horse and a chair, the role of a locomotive.

Characteristically, Biervliet himself, while describing the child's imagination as imitative, ascribes to it another attribute logically incompatible with imitativeness, namely, "improbability".

(125, 129); indeed, only real acts can be imitated while imitation is only possible in case we meet with a real corresponding object of imitation, so that neither imitative acts nor the products of imitation may seem improbable.*

We would like to offer several more facts attesting to the original, yet, undoubtedly, productive activities of children, which do not derive from imitation. In studying children's speech, F. Markey compared the names which junior and senior children ascribe to objects, things, animals and constructions. She found out that the former were more apt to invent "fancy" names, while the latter showed disposition for more realistic terms, i.e., they were imitating adults in a greater degree. L. Ames and J. Learned, while summing up the data pertaining to "fancy" games, played by children of different ages had to note that in babyhood (up to 3 years) and in early childhood children tend to "animate" objects and a child often makes believe he is an animal or a different person; however, all these games disappear almost completely by the beginning of adolescence. Consequently, a child's earliest games are distinguished by originality and "improbability", while older children try to imitate adults in their games.

Finally, in their earliest drawings, reflecting undoubtedly real objects, children are not imitating—in the exact sense of the word—what they perceive; they even are not imitating adults in their manner of drawing; all this comes later.**

Thus we have neither factual nor logical reasons to regard imitation as a "preparatory" stage of productive mental activity which, it seems, already manifests itself in early childhood, and independently of imitation at that.

Therefore, the two extreme views—idealistic and mechanistic—of the relationship between the process of phantasy on the one hand, and life impressions and age on the other, are equally unacceptable: we have to qualify as erratic both the opinion that age is detrimental to the process of phantasy, and the opinion that genuine productive activity emerges from imitation.

We base ourselves on the methodological presumption according to which the objective laws of productive activity

* In order to avoid a misunderstanding, it is necessary to mention that in principle we may also conceive imitation which is "improbable", yet it is only possible in case the imitated object is also a product of phantasy, for example, an imitation (reproduction) of a picture with a mythological plot.

** We included the problem of children's drawings in the context of problems of "imperfections" of intellectual activity (Chapter V).

are valid for any age: naturally, concrete peculiarities of different ages will influence differently the orientation of these laws, thus presupposing different results of the processes of phantasy. We would like to begin with the analysis of children's phantasy. At the initial stages of life, when the child has scanty knowledge about the external world, he often devalues the most essential distinctions in objects and phenomena (which he, generally speaking, is capable of differentiating), identifying them with each other (we discussed the typical examples above). He also is unrestrained in handling verbal material and he easily (by anaxiomatizing many linguistic rules and conventions) coins surprising and, at times, witty and unexpectedly successful neologisms, grammatical forms, word combinations and figures of speech. A great number of facts of the "play of children's phantasy" in this sphere were recorded in Kornei Chukovsky's most interesting book *From Two to Five*. At the same time, the mechanism of hyperaxiomatization helps children produce highly original phenomena. It is well known that random features and moments often gain a heightened evaluation in the child's psyche. He is likely to attach enormous significance to an infinitesimal, minute detail almost unnoticeable by adults, and it may become in his eyes a distinctive feature of a certain person ("the man who did not eat his pudding at dinner"). An incident which seems a trifle to everyone (say, damage of the favorite toy), assumes for the child the importance of a dramatic event.

We have already pointed out that a number of psychologists and teachers associate the development in a child of more rational forms of behavior, in particular, of logical thinking with attenuation and even cessation of phantasy. This opinion is stipulated, first and foremost, by the traditional narrowing of the notion of phantasy (see Chapter I), and, as we have already shown, by the idealistic interpretation of the essence of creativity. In reality, the laws of phantasy are re-oriented by the family and the surrounding people, educational measures and training at school. Quite naturally, this results in both positive and negative effects.

One of the earliest systematic studies of the influence of the family on the development of personal traits contributing to creativity was made by Anne Roe. In her opinion, the freedom which a child enjoys in the family, alongside the treatment he receives, plays a great role for arousing cognitive interests and aspiration for creativity. Therefore, the overly exacting attitude towards a child effects his developing strong

protective responses, while excessive care builds up in him so-called narcissism, i.e. self-admiration and self-content. And if a child is brought up in the atmosphere of neglect, he grows more interested in ideas and things rather than in people.

J. W. Getzels and Ph. W. Jackson based their analysis on questioning the mothers of students. They came to the conclusion that a child's disposition for creativity will be mostly developed in families that are tolerant of "deviations and distinctions" in the views and customs, and that regard condescendingly "risky exploits". Albert Dreyer and M. B. Wells elucidated the influence of the psychological climate in the family on the "creative behavior" of four- and five-year-old children; in particular, they established the superiority of the children whose parents are less demanding in subduing them to their authority and will.

We discussed above a number of socio-psychological factors detrimental to creativity. A number of authors noted that in capitalist countries such factors manifest themselves in the course of school training and education.*

Paul Torrance made a detailed analysis of various factors which suppress the creative orientation of schoolchildren. To these he attributed the students' aspiration for success, hence a fear of risk; their desire to resemble their peers and a fear of defying the accepted standards so as not to seem "anomalous"; the teachers' insistence on the roles to be played by one or another sex; the students' and the adults' set that school procedures have to be taken seriously and that they completely exclude any play, including the play of thought (266, 80-102).

The action of the factor "peer-group orientation" (essentially a striving for behavioral conformity), according to Torrance, is clearly noticeable by about the time the child reaches the fourth form when his need for consensual validation is intensified and when he becomes afraid that he might not resemble his peers (266, 99).

The investigation based on extensive factual material (2,000 students' essays) provided D. Delepine-Messe, who conducted it, with the conclusion that although the quality of the essays

* At the beginning of this century Lucien Dugas, an investigator of phantasy, wrote: "It seems that the principal effort of education is directed at combatting it [phantasy], if not at destroying or, at least, moderating and containing it. But the prejudices and the systems do not triumph over nature, they only serve to break it through" (143, 173). Modern bourgeois psychologists, however, in discussing the harmful effect of education, do not make such optimistic conclusions about the triumph of nature.

improves along with the progress in education made by students (in particular, the students of senior forms revealed fewer digressions from the assigned themes), their written works (practised in Belgian schools) were highly artificial by nature and restrained students from expressing their ideas creatively and sincerely.

The improvement of the quality of the essays of senior-form students in comparison with those of junior-form students had been noticed somewhat earlier by Soviet psychologist L. Nosova, when conducting investigations into the phantasy of fifth-seventh form students of a Soviet secondary school. However, in contrast to Delepine-Messe, Nosova characterized the essays of the seventh-form students as relatively independent works containing creative elements which serve to reveal the author with his own life experience and emotions (43).

The results of comparing the creative works performed by the children brought up in different social conditions would certainly have been more convincing if the matching data were obtained during a single investigation and evaluated according to strictly defined criteria. However, even the comparison of the results obtained by Nosova and Delepine-Messe indicates that the orientation of the laws of phantasy is not determined merely by the age or the very fact of training at school (it allegedly subdues the creative approach, sincerity, etc.), but it depends on the character of training and, even greater, on the social conditions in which a student lives and is brought up.

Foreign psychologists are also extremely sceptical about the role of the higher school for the development of creativity. R. L. Bednar and C. A. Parker conducted tests to discover no essential changes in the achievements characterizing the creative abilities of college students throughout the first three years of studying (120). John Bentley found out that the creative abilities of college students (determined through tests) had little effect on their academic results; Bentley explains this by the fact that academic examinations impose demands only on students' knowledge and memory rather than on their creative approach.

At the same time, the creative orientation of students presupposes an obvious positive effect. Thus, according to Welch, the creative achievements of art students are markedly higher than those of the students concerned with other specialities. The only acceptable hypothesis which, according to Welch, may explain the result obtained by him lies in the concession

that "the art student is encouraged from the start to strive for the new, the original product" (273, 145).

Consequently, the orientation and the results of the process of phantasy in both college and school students depend on the concrete relationship between the instructors and the instructed, on the demands which the former impose on the latter, and on the orientation imparted to them during a course of training. Thus, the development of creative abilities depends more on the peculiarities of training and education in secondary and higher schools than on age.

However, does age as such influence creativity? The first non-systematical observations provided us with the conclusion that young people have a better disposition for creativity. Wilhelm Ostwald wrote in his book *Inventors and Investigators*: "A person achieves his greatest productivity at the age of about 25" (224, 71). Ostwald explains the advantages of young age by the fact that young people are more courageous.

J. Bjorksten explains the drastic collapse of creative powers, which allegedly occurs soon after the age of thirty, by the overload and exhausting of internal reserves leading to the decrease of a creative potential. According to the data obtained by Joseph Brozek, the intellectual functions exercised by adults (such as speech, as well as the ability to comprehend and use words and expressions) showed no deterioration with age, but were likely to improve. However, the functions which are not specially exercised by adults in their daily life (for example, thinking by symbols) do deteriorate. Especially difficult for old people are the tests which have to be performed within a limited time, as well as those which imply finding new methods of solution.

Harvey Lehman devoted to this problem his monograph *Age and Achievement*. He analyzed biographies of many talented scientists and people in the arts to conclude that the most creative age for a chemist ranges from 26 to 30 years, for a mathematician, from 30 to 34 years, for a musician, up to 30 years, for a writer, up to 45 years, and for a philosopher, from 35 to 39 years.

A. F. Isaacs offers somewhat different figures. In compliance with his data, the greatest insight occurs in the artists at the age from 5 to 22 years, in musicians, from 4 to 23 years, and in writers, from 12 to 40 years.

The physiological factors explaining the attenuation of a creative potential, according to Lehman, may include general weakening of the organism, reduction of its resistance to fatigue,

worsening of the sensory and motive functions, various body ailments, and endocrine (including sexual) changes. Yet, the explanation based on physiological factors meets with serious objections. First, most ailments mentioned by Lehman are not typical of the age which presupposes the beginning of creative withering; second, all possible physical defects (including difficulties in general) do not necessarily suppress creativity but in a number of cases may even stimulate it.

We regard as more founded the *psychological* factors of reduction of creative potential proposed by Lehman, even though they are not specific for old age. According to Lehman, the persons who have achieved marked successes by the age of 30 or 40 do not strive for any new achievements any longer, while the people who have often been criticized and who have not gained due recognition succumb to apathy. That is to say that both easy successes and insurmountable difficulties and obstacles weaken the motivation for creativity in equal measure.

It would be necessary to note that a number of facts disagree with Lehman's conception. Many scientists and artists displayed great creativity right up to venerable age. Suffice to mention the names of Pavlov and Freud, Milton and Goethe, Lev Tolstoy and George Bernard Shaw, Toscanini and Picasso.

This means that it would be wrong to discuss the *immediate* dependence of creative rises and falls upon age. In our opinion, the peculiarities of manifestation of the intrinsic laws are mainly determined by such factors as motivation, knowledge, and personal features. Naturally, some of these factors may be, in one way or another, associated with various age characteristics. Thus, insufficient volume of knowledge is more typical of a young person than of an old person as a result of which children, for example, tend to generalize objects on the basis of random features. However, the same logical mistakes may be made by the adults if they lack the required knowledge or intellectual training. The same fully applies to the significance of motives. Naturally, the decrease of motivation as a result of failures will most probably take place after they have recurred many times, i.e. in comparatively old age, and one would hardly expect a person to achieve such great successes at the onset of his creative activity that he would give up the desire to move forward. Nonetheless, a certain decline of motivation is also conceivable at a young age in the case of extremely unfavorable circumstances or as the result of extraordinary early successes.

SUMMARY

In this chapter we have tried to integrate the factual material characterizing the conditions of the process of phantasy obtained by various investigators with our theoretical views.

We have considered a number of factors influencing the process of phantasy which we conventionally organized here into four groups to facilitate the analysis: motives, personal peculiarities, socio-psychological and age factors. In reality, the same psychological entities can be qualified both as motives and personal qualities, while socio-psychological factors often pose as motives.

This material is not considered by other authors from the standpoint of existing conceptions of productive mental activities. To illustrate this, the data on the personal qualities contributing to creativity were not juxtaposed to explicit or implicit contents of different theories on thinking and phantasy; as a rule, in textbooks and manuals, such data were presented in the form of additional information which, in the opinion of the authors, must not necessarily be in harmony with the laws of thinking and creativity rendered in parallel with it. By and large, throughout this chapter we have tried to prove that such an agreement is hardly conceivable.

The facts we have considered have enabled us to assert that the character of influence of such prerequisites as motives, personal peculiarities, social and age factors upon the process of phantasy is effected through the mechanisms of anaxiomatization and hyperaxiomatization. It is true that the realization of the main motives of phantasy presupposes the action of these two mechanisms while successful creativity mostly benefits from the personal features, as well as socio-psychological and age factors which suggest a specific orientation of anaxiomatization. In other words, various prerequisites (factors) may have a positive or a negative influence upon the results of phantasy depending on how they control the intrinsic laws. However, the prerequisites (factors) may affect only the *orientation* of these laws, the latter *preserving their power in every situation*. Consequently, all the theoretical models of phantasy seem incomplete and one-sided (thus, inadequate), if they ignore its intrinsic laws, the knowledge of which, as we have proved, provides us with a rational explanation of the significance of various conditions of the process of phantasy and with an opportunity to unify them in a single whole. As to the factors such as external circumstances which immediately affect the subject's psychic states, they are all included in the context of applied problems of phantasy (Chapter VII).

Chapter VII

PRACTICAL ASPECTS OF THE PROBLEM OF PHANTASY

Since the positive results of the process of phantasy are based on specific conditions (see Chapter VI), the problem of creating them acquires great practical significance. Some of the conditions, for example the optimum qualitative and quantitative composition of a creative group, do not necessitate any painstaking arrangements. At the same time, a number of other factors (for instance, such personal qualities as self-reliance and independence, non-conformism) result from long and multifarious didactical effects. We would like to start our analysis with consideration of the training procedures conducted to ensure stable internal conditions for successful creativity. Then we will dwell on the organizational and other procedures serving the same purpose.

TRAINING PROCEDURES

The training procedures recommended by psychologists for developing creative abilities derive from different theoretical conceptions of phantasy. The proponents of the idealistic view of phantasy maintain that as long as the latter is a primordial innate faculty, the subject has to be provided with an opportunity to fully reveal it. Some of the psychologists (namely, Hermann Toegel) stress that the dormant power of phantasy should be awakened in each student, while others, such as Alex Osborn, advise "to remove the blocks that are often in the way" (223, IX). Peggy Brogan advises to handle this power with caution and care (131, 14). Finally, Lawrence Kubie warns against curbing this internal power by ill-timed crude criticism, sneering and strict prohibitions (198, 41).

Mechanist psychologists express a diametrically opposite opinion concerning the solution of the didactic aspect of the problem of phantasy. Behaviorists contend that the development of the person's creative potential is almost identical with the forma-

tion of various automatic skills. C. Z. Hull was one of the most consistent defenders of this view. Recently similar views have been expressed by Frederick Bartlett, Irving Maltzman, George Polya, G. P. Guilford and other psychologists. Throughout his monograph on thinking Bartlett insists that this process be identified with a system of intellectual skills that are trainable by analogy with psycho-motor skills (119).* Maltzman and his associates staged several experimental series aimed at training individuals so as to improve "originality of response". They came to the conclusion that originality, too, is a trainable form of behavior which is the same, in principle, as any other form of behavior.

We find interesting the research conducted by M. Covington who trained students in the elementary grades to cope with creative tasks by advising them to select one of many probable ends to various stories. The experiment yielded data indicating that in the experimental group that had been thus trained 71 per cent of students gave correct answers, while only 29 per cent of those from the matched control group managed to cope with the same problems successfully.

In spite of the one-sidedness and thus inconsistency of the general theoretical premises of the above-mentioned psychologists, a number of their training procedures aimed at improving various aspects of the process of phantasy are fully justified in a great number of respects. It would be quite reasonable to train subjects in learning to find original answers, in the same way as it would be advisable to take all sorts of measures in order not to block their creative potential. Yet, these measures are instrumental only in solving specific practical tasks. At the same time, the solution of the problem of developing creative abilities in general is far too complicated, and it cannot be reduced to certain isolated procedures.

In relying on the premises of Chapter VI we can assert that the development of man's creative abilities is inseparable from the whole process of upbringing him as an integral personality with its many facets. Consequently, no partial measures, for instance, the "creative problem-solving course"** proposed by some psychologists, can secure the attainment of the main objective—the

* This idea was expressed most explicitly by Polya: "Solving problems is a practical skill like, let us say, swimming. We acquire any practical skill by imitation and practice" (231, 4).

** Sidney Parnes points out that the students who have taken "the creative problem-solving course" performed significantly better in six out of eight tests of creative ability than the students who have not taken this course; however, they preserved this edge for only some eight months (225, 146).

formation of man's creative abilities. Quite obviously, children have to be subjected to the necessary didactic effects as early as the formation of their characters begins and their internal motivational orientation starts taking shape. Many authors associate creative upbringing only with the course of training in universities and in senior grades of secondary schools; meanwhile, they rarely speak about creative edification in elementary schools, and they almost completely ignore this edification in early childhood. However, we believe that a number of recommendations aimed at developing the creative faculties of school children may equally well be applied in the upbringing of pre-school children. In support of this premise, we would like to begin by specifying the techniques which are sure to arouse children's curiosity and interest. Thus, they can be, for example, familiarized with various puzzling objects and phenomena, or their attention can be captivated by exciting and thrilling stories read to them (139, 135).

It is extremely important to ensure the development of children's individual faculties without suppressing some forms of their eccentricity which, as we could see in the previous chapter, are often suggestive of their disposition for creativity. In the process of upbringing, it is extremely important to instill in children the conviction that courage, boldness, independence and honesty have to be displayed in most diverse spheres of human activities, including the sphere of mental activity. From early years a child has to be taught to boldly express his own original and critical judgments, and in helping him realize his mistakes, adults should not regard them as something shameful, unacceptable, or even undesirable.

It has long been proved that teachers' demand for strict obedience from their students often causes the latter to develop a negative disposition for studies, apathy and fear of unbiased mental activities; at the same time, a benevolent attitude toward them on the part of teachers alleviates their fears of displaying their creative capacities. Considering that children are extremely sensitive to the evaluations of their mental activity, adults have to be very tactful and cautious in their judgments, trying not to hurt a child's sensitive dignity.

In the previous chapter, we mentioned a number of highly important for creativity personal qualities, such as perceptivity, persistence, readiness to tackle complicated problems, kindness, "playfulness", readiness for increased complicatedness, aspiration to self-perfection, lack of complacency, etc. By instilling these qualities in children, we essentially promote the development of their creative abilities.

At present, we possess several well-founded recommendations for developing creative abilities in secondary and higher schools. Investigators regard the consideration of school children's peculiarities and individual training as one of the basic factors for the creative upbringing of school children. This was discussed at length, in particular, by Beryl Ash and Barbara Rapaport in their *Creative Work in the Junior School*. They believe that individual assignments are especially desirable for ensuring most sincere, i.e. independent, non-conformable expression of emotions by school children (113, 39-56).

School children should be convinced that a creative approach to any problem will be highly appreciated by their teachers and by the group. Almost all the authors stress the need for infusing a creative atmosphere at school and for ensuring a considerate and sympathetic attitude toward the students' searches and original ideas, even though they may seem awkward and erratic at first sight. Teachers have to take care of creatively gifted students and, in particular, not to allow them to become isolated.

At the same time, it would be wrong to try to eliminate all the difficulties which they are likely to confront. On the contrary, students have to learn to independently overcome every obstacle blocking their own thinking. According to many psychologists, this may be achieved by the so-called training through the discoveries made by the students, or problem-solving which has to actively guide them to various conclusions by way of summing up and juxtaposing the observed facts. In addition to the fact that students acquire more profound knowledge in the course of problem-solving training than in the course of the traditional training, the former helps activate their creative potential.

In the Soviet Union, problem-solving training has been applied in many secondary and higher schools. Its principles and results are set out in the works by I. Lerner, E. Mirsky, L. Zorina, N. Alexeyev, and E. Yudin published in the book *Nauchnoye tvorchestvo* (Scientific Creativity, Moscow, 1969), and in A. Matyushkin's extensive monograph *Problematičeskie situatsii v myshlenii i obuchenii* (Problematic Situations in Thinking and Education, Moscow, 1972). Certain psychologists see the basic principles of problem-solving training in creating situations that guide and stimulate the mental efforts of students.

We fully agree with the opinion expressed by these pedagogues and psychologists who advocate problem-solving training and see a number of ways to stimulate the creativity of higher and secondary school students, even though the main objective of such training will not be achieved unless the problems are posed by the students

on their own. Naturally, both in the course of the problem-solving and the traditional training we are running a risk of compelling a student to shun active display of his creative capacities, thus confining him to the search for answers to the teacher's questions. George Polya made a very subtle remark that many of teacher's questions will not be instructive unless the students understand "how the teacher came to the idea of putting such a question" (231, 21). Therefore, "it is necessary ... that the students may have as great a share of the work as possible" (231, 20).

A question arises whether it is possible to apply program-training for the development of creative capacities. Does it agree with the requirement for displaying creativity? By and large, if we presume that program-training is based on special algorithms and that its application is reduced to simple solutions only, the programming of creative activity will appear to be completely absurd since the latter consists in finding original and multifarious answers. However, we deem it advisable to apply the unquestionable advantages of program-training to the development of creativity provided we have considerably supplemented it with new principles. Let us analyze some of the principles we have proposed to achieve that purpose (57).

To begin with, the tasks that comprise the programs have to be characterized by certain diversity. Alongside tasks that are aimed at working out a rule or an algorithm, the program has to include non-standard problems which involve guess-work for their solution. Such problems also permit the utilization of feedback connections widely adopted in program-training since this case presupposes direct answers.

In our opinion, it would be justifiable to include into the program tasks suggestive of several equally valuable and equally acceptable solutions. Such may be the case when a student is advised to compile a plan of a lesson from his textbook, to invent a title to a text, to select the necessary epithets, to translate a phrase from one language into another, etc. In fulfilling such tasks and in checking his results against those presupposed by the program, the students will realize in each particular case that his problems may often have multiple solutions.

The plurality of answers opens new opportunities for programming, further adapting it to the requirements of developing students' creativity. It is true that, if a problem presupposes several solutions, there would hardly be the need to specify each one of them, provided we have clearly circumscribed the set

of phenomena and notions containing the relevant answers. Self-check, too, may no longer be regarded as a mere mechanical correlation (matching) of what we have accomplished with what we were to accomplish, for it turns into a creative act in itself necessitating resourcefulness even at the final stage of problem-solving. As an illustration of such tasks we would like to refer to students' compilations of problems with respective preset answers that contain only general indications of the limits within which various data, formulas, etc. may be utilized.

Let us consider one more form of training which we have designated as *self-programming*. There is a number of schools which practice self-evaluations by students of their own works, achievements and essays. All this may be regarded as the initial stage of self-programming.

In senior forms, it would be advisable to practice the programming of such works as essays, synopses and reports, which presuppose creative approach. It would be important to note here that students are supposed to self-program the patterns for the works they will have to perform; to be more exact, students are supposed to preset the basic requirements to the logic and form of rendition, composition, style and volume of their tasks, and the method and character of utilization of the literary and factual sources, etc.

Self-programming imposes its demands on creativity from the start, as soon as students address themselves to the assigned task, and it serves as the prototype of self-instruction (to be discussed below) indispensable for creativity. It goes without saying that the problems of self-programming, as well as the other aspects of the utilization of programming, call for further investigation.

The works of certain psychologists contain references to one more powerful didactical lever capable of augmenting the creative potential, i. e. the knowledge of the laws of creativity. I. A. Taylor, in particular, maintains that the advantage of the great creative personalities lies in their realization of the mechanisms of mental activity, the peculiarities of its dynamics, as well as in the penetration into the essence of the creative process itself.

Torrance, Parnes and Boirel emphasized the need to provide students with some information pertaining to the character of creative process (225, 161; 128, 88-89). According to them, a student not only has to be taught to evaluate the conditions of his task and to perform the necessary operations with the object of his investigation, but he also has to be trained to evaluate correctly the course of his thinking and his attempts

to solve the problem. As long as his errors, as we have seen, are mainly stipulated by the internal laws of mental activity, it is extremely important to make him realize on his own which of these laws produces the unfavorable effects. This knowledge will enable him to completely eliminate or, at least, to minimize the number of errors. Therefore, let us first of all consider all the possible ways of overcoming the unfavorable effects of hyperaxiomatization.

As was shown above (see Chapter IV), the most essential negative effects of hyperaxiomatization are in the preferences which the subject is apt to give to a highly limited number of variants of the solution. We would like to offer the following method for exposing the object of hyperaxiomatization. A student, as well as any other creative worker, has to compare several variants of a solution in order to determine the technique which is persistently recurring—that is to say, to determine the aspects that constantly attain a heightened evaluation obscuring other possible ways of the solution. It is important to train students to notice on their own the frequency with which they repeat in their essays the same expressions and figures of speech, similar and even identical constructions and, which is worst of all, stereotype ideas. We have to keep the students away from the temptation to avoid the difficulties presupposed by the creative process and to follow the well-trodden path. It is advisable to use concrete facts in order to convince the students that each time the texts of their essays appear to be overly smooth and polished from the start, they can hardly be expected to be characterized by either originality or unbiased thinking, since true creativity has to result from a struggle against borrowed and stereotype ideas, as well as hackneyed forms of rendition.

Time and time again, man has to turn to what he has created, since the mechanism of hyperaxiomatization causes him to overestimate the actual value of his accomplishments at the moment when he is creating his product; some time has to pass before man can take a more critical approach and see more clearly the places which particularly need improvement. Moreover, eventually man starts to discover additional variants he has not seen earlier, for they have been obscured by the same mechanism of hyperaxiomatization.

In his *Letter to the Pisos* the Roman poet Horace advised his colleagues to keep their completed works unpublished for nine years. Such advice seems naive and even harmful today when we see rapid development of science and art. Nonetheless, the poet's main idea has not lost its relevance: one should realize

that it is impossible to create anything really new and original in haste. When the first joy at accomplishment cools down and some time elapses, man inevitably experiences the urge to improve, verify, alter and transform the product of his work.

While working on his *Childhood*, Lev Tolstoy entered the following idea in his diary: "I have to give up the thought of writing without amendments once and for all. Even three or four times of re-writing are insufficient" (93, 114). Quite naturally, these amendments should not turn into an end in itself, or else the final results will be put off infinitely. Therefore, it is not advisable to combat all the manifestations of hyperaxiomatization, the stabilizing effect of which has to assist in making a point of something.

Conclusions of equal practical importance derive from another law of phantasy: the mechanism of anaxiomatization. We have already observed that many erratic and illusory solutions often result from the subject's neglect of a certain essential condition of an assigned task or of a certain essential property of one or another notion he has to deal with while accomplishing his task. Meanwhile the correct solution, too, presupposes anaxiomatization, thus the subject has to realize at what object it is directed and what information has been devaluated or ignored. Even at school students should be trained to consider whether everything has been taken into account and whether none of the essential information has been ignored by them, whether consciously or subconsciously, while they were accomplishing their task. On the other hand, in solving their problems they should deliberately discard all the earlier-hackneyed ways of solution, the earlier concessions and factors, i.e. everything which can assume the power of dogmas and prejudices.

It would be extremely important to train students to select and abridge the materials on their own which will aid in the realization of the essence, the formation of notions, etc. Students have to be trained to independently root out the unnecessary and to devalue the irrelevant. A teacher who performs this in their stead interferes with the development of their creative abilities: while accomplishing creative tasks, students have to go "through the pains" of applying the maximum of their creative efforts. Ya. Ponomarev asserts that a prompt in working out a puzzle may only be of help when the subject has spent much time trying to unsolve it himself (47).

No doubt, psychology will provide us with a great number of effective techniques for developing creative abilities, yet the aforesaid convincingly proves that such education involves con-

tinuous and painstaking efforts and skills and, which is most important, the awareness of the psychological nature of the process of phantasy.

ORGANIZATIONAL PROCEDURES

Alongside the didactical measures indispensable for continuous and successful creativity, an extremely important role is attributed to organizational factors the intent of which is to ensure high efficiency of the subject and to preserve in him a psychological state vital for creativity.

It has long been noticed that in the process of creativity people resorted to all kinds of ingenious ways to, supposedly, enhance and sharpen their attention, inspiration, and creative activity. To prove that, we can mention the proverbial habits of various outstanding people in the arts and sciences (inhaling the smell of orange peels, stroking a favorite pet, etc. while engaged in the process of creativity). Whenever such habits grow into an essential need, each time a creative person is unable to satisfy it, he will experience a feeling or state of discomfort hindering his work. This explains why it is not advisable to obstruct such harmless habits.

The authors who study the impact of various external factors on creativity focused their attention on the bent of some people to work in the most odd conditions, for example, late into the night, in bed, in the bath, etc. (223, 206-09). There are also some allegations concerning the stimulating effect upon a creative person of alcohol and some toxic agents (196, 246, 214, 161). However, a person should never become a slave to external factors and, moreover, to habits harmful to his health.*

Among other factors which serve to immediately effect a creative disposition, we would like to mention the exclusion of various irritating agents that hinder concentration, and the availability of a certain period of "penetration into the subject matter". Most emphatically, a person should also be able to switch the objects of his creativity, in particular, to withdraw for a time from his principal creative problem. This implies the need to take into account the so-called *incubation* stage of the process of phantasy. The creative workers' regimen has to envisage the

* Foreign psychology often attaches extremely great significance to external factors which, allegedly, have an immediate influence on the character and results of the process of phantasy. Salvatore Maddi and his colleagues, in particular, have established that external recurring stimuli, for instance, interfere with active thinking.

switching of attention over to the objects which are not directly associated with the principal problem. Hence the practical conclusion: it is advisable to work simultaneously at different problems (227, 60-61).

Some psychologists studied the influence of instructions on the process of phantasy. P. Christensen, J. Guilford and R. Wilson pointed out in their works that if the instructions contain the demand "to be sensible", the quality of the answers produced by the subjects improves even though their number decreases (the experiment had the subjects write titles to plots).

D. M. Johnson and D. J. Zerbolio who conducted the same experiment with minor modifications came to the conclusion that the instructions "to write clever titles" were no more effective than instructions "to write appropriate titles" (193, 214). And yet in the experiments staged by Johnson and Zerbolio the instructions, certainly, had to play a positive role.

In relying on the data of their experiment, M. E. Manske and J. A. Davis assert that the two instructions (to be original and to be practical) augmented, respectively, the number of original and practical ideas; however, when the instructions had it that the subjects were supposed to be simultaneously original and practical, the number of respective ideas was unchanged as compared with the instructions to be neither original nor practical. Consequently, instructions may help achieve the improvement of one of the above characteristics; either originality or practicality.

Löwy proved the effectiveness of the instructions which demand that the subject play a specific role, for example, that of a person displaying original attitude toward his test. Philip Vernon emphasized that thoroughly elaborated instructions considerably improve the quality of thinking.

Thus, the majority of investigators are in agreement that instructions containing special guidelines, as to how to perform a task, augment both some qualitative and, undoubtedly, quantitative results of creativity. We are inclined to regard instructions as an essential motivating factor which becomes especially effective when a subject is guided by the internal aspirations that manifest themselves as *self-instructions*, rather than by the external demands. In the previous section of this chapter we analyzed in detail the possible ways of developing creative abilities by self-programming; it is quite probable that this type of education will help a person develop the ability to adapt self-instructions to the mental activity.

The recent years have seen a number of proposals to apply various organizational procedures to stimulating creativity.

Among these we would like to single out brainstorming and synectics as the methods especially favored by foreign psychologists.

Brainstorming is usually associated with the name of Alex Osborn, even though he himself asserts that he used this term to denote the principles and procedures which "have been known and used by creative thinkers for many centuries" (223, VII).

In our opinion, the main characteristic feature of brainstorming consists in the fact that in the course of the collective discussion of a creative problem every participant has the right to express any judgment even though it may, on the face of it, seem unfounded and even absurd.

According to Osborn, collective thinking stimulates the "associative power" of the panel owing to an increase of rivalry and contributes to a more unrestrained expression of ideas (223, 83). Since one of the most essential rules of brainstorming prohibits criticism of any of the expressed ideas, it helps, in the opinion of its adherents, to eliminate the internal motives obstructing the "flashes of thought" and interesting guesses. These motives also include excessive self-criticism and the fear of being misunderstood or ridiculed, the reluctance to conflict with certain people and with their habitual judgments and opinions (124, 26).*

While pondering over the problem, each participant of a brainstorming session has to pose and answer various questions, such as: how can one or another object be adapted to other purposes? can the shape and size of the considered object be changed? can it be combined with another object? what is there in this object that can be restructured or replaced? what substitutions of its various parts and components may be made? how can its employment be broadened or restricted? etc.

The participants of the brainstorming sessions (not more than five to twelve persons) should include both experienced workers and novices endowed with equal rights during the discussion.

In this connection, special demands have to be imposed on

* A collector of Russian folklore, V. Gusev, offers the following observations he made during competitions of *chastushka* improvisors (*chastushka*—folk verses, usually of four lines, composed on the spot and humorously and lively sung by the country folks at their get-togethers): "During this competition, even the most untalkative and shy youths and maidens who were assuring the collector that they did not know a single *chastushka*, suddenly (sometimes unexpectedly even for themselves) joined the merry dance and began to 'versify' *chastushkas*. When I asked these 'potential' *chastushka* improvisors to repeat their stanzas, they refused to do so" (20, 230).

the leader who, on the one hand, should abstain from exerting pressure on the members of the group and, on the other, he has to rule out criticism, no matter by whom it is expressed, which can affect the creative initiative of the participants of brainstorming sessions (223, 80-87). At the same time, the leader has to be sufficiently active in order to draw the attention of the participants to the core of the problem: he has to infuse the group with the "atmosphere of relaxation and freedom", to maintain and enliven the discussion (124, 33). The essence of the brainstorming lies in the generation of ideas which are only registered as they are being expressed and which are evaluated later by the people who did not participate in the first stage of the session. The value and effectiveness of the method proposed by Osborn were verified by many psychologists. A. Meadow, S. Parnes and H. Reese who pioneered in this field of investigation made a conclusion that the group in which the criticism of ideas was prohibited generated more ideas than the control groups in which evaluation and criticism of the expressed ideas were permissible. Edith Weisskopf-Joelson and T. S. Eliseo confirmed the conclusion of the previous authors pointing out, however, that the quality of ideas generated by the groups whose members evaluated their expressions critically was higher as compared with the ideas generated in the conditions of the orthodoxal brainstorming. In analyzing the drawbacks of the brainstorming, some psychologists maintain that the data obtained through this method are extremely cumbersome and require long processing (130, 116).

Some of the investigators discovered certain facts conflicting with the predictions made by Osborn and other enthusiasts of his method. Ernest Hilgard, for example, relies on the data provided by a number of experimentors in order to prove that brainstorming does not necessitate the emergence of unique and valuable ideas: moreover, a group involved in a creative process is likely to inhibit the creativity of individual members of the group. At the same time, Hilgard has to concede that by being engaged in group discussions the participants are trained to develop the mood contributing to generating ideas. An individual who has mastered the brainstorming principles can easily apply brainstorming himself (184, 171).

Guilford believes that the individual form of brainstorming is more productive than its group counterpart, and that only the demand not to criticize the ideas occurring to individuals has to be preserved ((170, 446). T. J. Bouchard and M. Hare share this opinion and they conducted an experiment to prove that group brainstorming is more likely to impede rather than to

facilitate thinking, individual brainstorming being by far more effective.

Some of the psychologists have gone even farther in their attempts to downgrade the very theoretical foundation of brainstorming which implies that a prohibition to evaluate the ideas occurring to a person increases the productivity of the process of phantasy. Thus, Johnson and Zerbolio are basing themselves on the diametrically opposite premise: they assert that deliberate evaluation (or judgments) is expected to facilitate the generation of ideas (193, 209).

As we have already noted (Chapter VI), collective thinking is essentially advantageous as compared with individual thinking only when it creates more favorable conditions for adequately oriented anaxiomatization. Brainstorming presupposes such conditions to the extent to which it prohibits the "protective" or the "conservative" criticism of new ideas, such criticism resting on deep-rooted dogmas, prejudices and stereotype solutions, which, in particular, have to be subjected to anaxiomatization. Yet criticism does not always have to be protective; it may often be directed at prejudices, dogmas and stereotype solutions. In this sense, the so-called deliberate evaluation to which Johnson and Zerbolio attach special significance increases the opportunities for the necessary anaxiomatization with equal success.

Quite understandably, a number of other ways for increasing the opportunity for adequately oriented anaxiomatization are also feasible. In this connection we would like to mention the method proposed by William Gordon in the early sixties and termed *synectics* (the word is composed of two Greek roots denoting a combination of heterogeneous elements). Gordon believes that the decisive factor for generating ideas is the procedure which he defines as "making the familiar strange". This implies the following: a person is making an attempt at having a *new* look at something familiar, he deliberately assumes the standpoint which is different from the one commonly accepted, and he develops an unusual attempt toward well-known phenomena and objects. Along with this, Gordon also implies the distortion and the original change of habitual ways of perception and response (166, 34-36).

How can "making the familiar strange" be achieved? Obviously, it would be quite reasonable to presume the need for a mental mechanism capable of devaluating the habitual, the familiar and the commonly accepted. However, Gordon fell short of making such a conclusion, for he attributed the main role to different types of analogy: alongside the traditional analogy

he singles out the so-called personal and symbolic analogy. According to him, personal analogy serves to identify the subject with a considered object, for example, the author of a project may ask himself: "What would I experience if I were a spring in this mechanism?" "What external and internal effects would then be most inconvenient for me?" In discussing the symbolic analogy, the advocates of synectics mean the utilization of visual symbols, as well as verbal metaphors for forming unexpected combinations.

In our opinion, the likely positive effect of this method may be explained by the fact that it does not confine a search to a single direction, thus creating favorable conditions for devaluating habitual views.

In the same way as brainstorming, synectics is employed collectively, yet it may also be practiced individually. At the beginning of a synectical session, the leader presents a task to the participants. In contrast to brainstorming, synectical sessions do not presuppose any excitement of the participants and they are characterized by greater purposefulness. The participants of a synectical session begin generating analogies by trying to liberate themselves, to "clear themselves" from the ideas which occur to them immediately after they have been set the task since quick solutions are normally based on the traditional approach or on the traditional methods. As soon as the participants of the session agree on a productive analogy, they begin a detailed and thorough analysis of the logical implications (consequences) which it entails.

H. Rugg believes that the main advantage of synectics, as compared with brainstorming, is its moderate character which does not require of the participants any strain and which presupposes their purposeful drive for qualitatively valuable ideas rather than for a mere quantitative piling of such ideas (241, XV). Geoffrey Broadbent asserts that synectics draws on the subtle specific processes and the whole creative capacity of the brain while brainstorming could be computerized as long as it presupposes a mere actualization of random associations (130, 117).

The current need for finding creative solutions to the skyrocketing number of practical problems facing the capitalist countries has engendered a boom and a great demand for fashionable methods of stimulating creativity. By using this situation and by taking advantage of the credibility of the general public, ingenious authors are flooding the market with all sorts of fantastic projects and insipid recommendations which, according to Gabriel and Brigitte Veraldi, are often nothing more

than a sheer stupidity (267, 29-32). Heaps of books and booklets published in the West contain a puzzling combination of recipes for optimizing creativity with scientific truths borrowed from different and often conflicting teachings. The common feature of many novel "methods of creativity" is their opposition to logical thinking. They include the so-called lateral thinking proposed by Edouard de Bono, "sleep-writing" (which implies utilization of unconscious associations) proposed by Guy Aznar (114, 47), random searches through catalogues and dictionaries in order to strike upon a lucky idea [Broadbent (130, 115), Arnold Kaufmann, Michel Fustier and Annik Drevet (195, 52)] and others. Obviously, a certain productivity of these "methods" results from a neglect of deep-rooted views and recognized methods of problem-solving rather than from heedless attitude toward the rules of logics.

SUMMARY

Psychologists, pedagogues and organizers concerned with scientific researches and projects have worked out a great number of concrete recommendations on creating favorable conditions for creativity. We have been trying to prove that the successfully applied didactical and organizational measures considered in this chapter fully agree with the conception of phantasy we proposed in this book. One may presume that different methods of stimulating creativity and generating ideas are supported (though not obviously) by one of the general laws of the process of phantasy, i. e. the mechanism of anaxiomatization proposed by us. Naturally, not all the practical conclusions deriving from the theoretical premises, which themselves call for further verification and improvement, have been fully realized. At the same time, we believe that our conception is conducive to whole number of new practical recommendations the realization of which will enhance the positive effects of the process of phantasy.

GENERAL CONCLUSIONS

In this investigation we have not tried to embrace and expose the whole range of problems of phantasy. Our purpose was to reveal some of its intrinsic laws. However, even this task, narrow as it was, brought forward a whole number of serious methodological problems associated with the general theoretical difficulties of psychology (Chapter III). Up to now we meet with different interpretations of the nature and essence of the indispensable links which psychology can and must define. To the researchers who believe that psychology is confined to a mere description of facts while their explanation is the prerogative of other sciences (for example, physiology, cybernetics, sociology), a search for psychological laws seems to be absolutely senseless. All doctrines which ultimately reduce psychological phenomena to various direct and indirect external influences in fact also deny the existence of intrinsic laws in psychic processes as well as in phantasy. To crown all this, the nihilist attitude toward the search for immanent laws is typical of the psychologists who regard activity as a special phenomenon existing independently from objective cause-and-effect relations and identified with the final explanatory instance.

However, even the investigators who recognize this specific nature of the psyche and who admit the possibility of defining its laws cannot agree concerning the theoretical tenets which have to be raised to the level of genuine laws of phantasy. In this respect, in spite of a great number of theories and hypotheses (considered in detail in Chapter II) we can single out only two entirely different approaches.

In compliance with one of these approaches, the sphere of psychology should not extend beyond the most general formulations of the "laws" of phantasy, such as, for example, voluntarist and intuitivist assertions on the subject's innate abilities to create the new.

These excessively general, and therefore superficial formulations of the "laws" of phantasy were, first and foremost, counterposed by the theoretical premises reflecting specific, narrow aspects of creativity as a result of which the latter was watered down to the extreme and reduced to the Locke scheme, according to which human brain was only capable of performing a limited number of acts, i. e. decomposition, association and generalization; these, however, also included recombination and formation of images and ideas by analogy. As to the leading psychological trends, which were developing in counteropposition to the voluntarist-romantic approach to creativity, they attributed to the subject a merely passive role. Indeed, behaviorism, Gestaltpsychologie and psychoanalysis place phantasy in equal dependence on the factors uncontrollable by the subject or his will: behaviorism associates creative accomplishment with random external discoveries, Gestaltpsychologie, with the action of self-regulatory mechanisms, and psychoanalysis, with unconscious processes.

The polarity of the two extreme approaches to defining the laws of creativity thus rests on the alternative which, as it may seem, may be encountered by any theory of phantasy: either to recognize the subject's decisive role in a creative act at the expense of giving up the possibility of defining the concrete and objective laws of phantasy; or, on the contrary, to recognize the objective laws of productive mental activity at the expense of isolating them from the subject, even though certain theories ascribe to him the possibility of accomplishing individual acts which are part of the creative process.

Is this alternative overcome in the proposed conception of phantasy?* The experiments described in this investigation (Chapter IV) revealed two internal mechanisms of phantasy: anaxiomatization and hyperaxiomatization (respectively, a devaluation and an increased evaluation of certain information or of one or another way of fulfilling a task). Both mechanisms are closely interconnected and they invariably exercise their effect on any productive mental act. In this sense, they may be regarded as *objective* laws, i. e. acting independently from the subject's will. However, these mechanisms may produce both positive phenomena (solutions of non-standard problems, abstraction, creation of generalized, schematic and weird images, stable orientation of thinking, reduction of the area of search, etc) and negative phenomena (illusory solutions, logical errors, unreal "fantastic" constructions, distorted drawings, narrowing of the range of variants of the solution, etc.). This means that the presumable

internal laws (mechanisms) in themselves do not automatically insure the desirable results (which is asserted, for example, by the theory of self-regulation). Because the nature of these mechanisms is objective, they can neither be discarded nor altered by the subject. However, as long as an axiomatization, in compliance with the proposed conception, has a non-predetermined character, the subject can direct it one way or another. In this sense, the results of the process of phantasy essentially depend on the subject and on what he desires to devalue in particular. We regard the practical measures aimed at optimizing creativity considered in Chapter VII as the subject's real opportunities to make use of the objective laws to his own advantage.

Thus, we succeed, as it seems to us, in effecting the synthesis which had been difficult for many theories of phantasy, i. e. in combining the recognition of the objective laws of this process with the recognition of the subject's active role. At the same time, we overcome two extreme and equally unacceptable ways of defining the laws of phantasy: on the one hand, as excessively general premises completely divested of the factual basis; on the other, as particular dependences. Since the possibility to apply the theory to the maximum range of diverse phenomena increases its heuristic significance, we have attempted to prove that the proposed conception of phantasy in its concrete content agrees with the data, accumulated by psychology and by the adjoining sciences, which characterize creativity (Chapter V), as well as the conditions favorable for its process (Chapter VI).

The expansion of our knowledge of the subject resulting from further differentiation and improvement of research methods, as well as penetration into the essence of the object of our study will help us expose the fundamental laws whose particular manifestations are the mechanisms of an axiomatization and hyperaxiomatization postulated by us. This explains why it would be wrong to regard these laws of phantasy as its determinants in the last instance, for it is quite possible to approach them even closer, in particular, by conducting new purposeful series of investigations into concrete kinds of creative activity by means of modern methods and by elaborating a specific conceptual apparatus. However, at the present level of our knowledge of productive mental activity, the mechanisms of an axiomatization and hyperaxiomatization enable us to explain a wide range of concrete facts, including some more general phenomena which served as explanatory notions, for example, analogy, abstraction and symbolization, in certain theoretical constructions. We see the adequacy of the proposed conception of phantasy mainly in the

fact that in contrast to the schemes of intellectual activity deriving from Locke's teaching, it, undoubtedly, reflects the essential features of creativity. By and large, the mechanism of anaxiomatization ensures the emergence of the new not only through the devaluation of deep-rooted bonds, differentiations and combinations (as the traditional terminology has it, "by analysis, synthesis and recombinations"), but also through the devaluation of any method of fulfilling a task, through the very approach to this method, as a result of which we can expose essentially new aspects of the object of phantasy, new standpoints at this object, as well as realize a transition to different levels of generalization. Consequently, anaxiomatization engenders not only new products of phantasy, but also new techniques of mental activity, new "ways of thinking", thus demonstrating the inexhaustible nature of creativity.

One of the general conclusions of this investigation implies a reconsideration of the very notion of phantasy which we previously defined as productive mental activity (Chapter I). We have every reason to include into the definition of phantasy the psychological characteristic of its essence, which in the light of the proposed conception consists in effecting a *shifting of evaluations* of any kind of information, as well as of any ways adopted for accomplishing mental acts. We can hardly regard as unjustifiable the concomitant widening of the canonized classificational boundaries since the expansion of the notion of phantasy is achieved by applying objective laws to numerous and seemingly disintegrated entities rather than by reducing its content. This interpretation of phantasy obviously extends beyond the framework of the traditional interpretation of thinking which infrequently identifies psychological and logical categories. The peculiarities of the proposed internal mechanisms of phantasy, in our opinion, enable us to reconsider the approach to the very psychological nature of mental activity and to question the legitimacy of the sharp division of the procedural essence of emotional and intellectual phenomena. Indeed, the shifting of evaluation stands forth as a distinctive feature of a great number of phenomena in the emotional sphere (a heightened evaluation of the objects of positive emotions and a devaluation of the objects of negative emotions). Naturally, all this deserves special research, yet the new problems posed in at the end of this investigation serve, we believe, to indicate its productivity..

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